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CONSERVATION *and* NATURE ACTIVITIES

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CONSERVATION
and
NATURE ACTIVITIES

Compiled by
CANADIAN NATURE MAGAZINE
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AUDUBON SOCIETY OF CANADA
TORONTO, CANADA

CONSERVATION and NATURE ACTIVITIES

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PREFACE

The purpose to which the Audubon Society of Canada has set itself is that conservation is a moral and social obligation that must be assumed by everyone. Youth and adult education in conservation, particularly conservation education in elementary and secondary schools, is essential. People must develop an awareness of the need for conservation of our soil, water, timber, plant, scenic and wildlife resources. Our public schools, with adequate attention to the subject, can do more in developing sound conservation concepts, attitudes and habits over a period of years than any other process.

Education, information, research and other measures are employed by the Society. Here are some of the ways in which Canadians share in the pleasure and usefulness that Audubon activities assure:

CANADIAN NATURE MAGAZINE, which comes five times a year to every subscriber, with its marvelous illustrations—interesting articles by leading naturalists and conservationists—wildlife photography—community conservation measures.

AUDUBON JUNIOR CLUBS bring this fascinating knowledge of Nature to hundreds of thousands of Canada's future citizens, who have enrolled in these Clubs. There they learn to appreciate birds and other animals—the needs of soil, forest and water conservation—the interdependence of wildlife and the land.

AUDUBON SCREEN TOURS which bring the finest wildlife and scenic motion pictures and outstanding naturalist speakers to audiences of adults and school-students throughout Canada.

CONSERVATION AND NATURE ACTIVITIES. Years of study and research have gone into the production of this book. The entire contents have been checked by authorities. It can be used with complete confidence in elementary and secondary schools. The Society's publications and services should be used to the fullest extent. Please show this book and CANADIAN NATURE MAGAZINE to friends, neighbours, teachers, librarians and leaders of young people. Encourage them to use this book and the magazine, so that they in turn will interest others in nature, the outdoors and conservation. Your cooperation will be most helpful and sincerely appreciated.

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SECTION ONE

Teachers Guide to Conservation Education

SEVEN CHAPTERS

NATURAL resources, both physical and human, are the most precious possessions with which any nation is endowed. Instructional work which involves a careful analysis of "wise use" and the development of necessary skills, attitudes and appreciations essential to its effective application is a major responsibility of every teacher.

This resource guide, adapted to Canada, is based on a careful analysis of the current needs in conservation teaching and its psychological presentation to students. The almost complete dearth of organized, well-illustrated, and usable material prompted the publication of this curriculum guide.

The format is in keeping with curriculum policies and programmes. Chapters cover the six areas of conservation as follows:—(1) Conservation of Our Soil; (2) Water Conservation; (3) Mineral Conservation; (4) Forest Conservation; (5) Wildlife Conservation; and (6) Recreational, Scenic and Historic Resources.

It is hoped that this resource guide will provide a tool for all teachers. It is the teachers, and the teachers only, who can most effectively emphasize the fine lessons of conservation to the youth of our land.

The Point of View

The Importance of Conservation

It should be clear to all of us that man is absolutely dependent upon the resources which he can find upon this planet. The everyday needs of his life can be supplied only by drawing upon these resources. Some of them are renewable, but some cannot be replaced as man uses them. Upon their quality and abundance depends the social as well as economic well-being of man.

During the centuries in which our civilization has been developing, the rapid and intensive utilization of natural resources has been the source of the economic power of the nation. History has shown us that the downfall of other and powerful civilizations may be attributed to the exhaustion of their natural resources. Here in this country, the original abundance of natural resources led to a frame of mind that deemed the storehouse of our treasures inexhaustible. It is only comparatively recently that we have been forced to realize that the forest is not endless, the fertility of the soil is not boundless, the replacement of slaughtered game is not limitless, and the purity of our streams and lakes is not inviolable. The complete loss of some of our resources and the accelerated rapidity with which others are disappearing or disintegrating make it imperative for us to urge proper conservation more forcefully than ever. We need to develop an awareness of this emergency, and to inform those who do, or will, determine future policy of the best known solutions of the problems which beset the utilization of our resources.

The welfare of ourselves as well as of those to come hangs in the balance. It is only through a wise use of our natural resources that we can maintain a happy, prosperous nation. To meet the challenge of teaching this wise use should be the aim of conservation education. From the earliest grades and extending through the high school, conservation education should be carried through the entire curriculum.

The Role of Conservation in the Curriculum

Conservation, then, must become a part of the broad, general education of all youth. This conservation resource material can be fitted into the curriculum pattern of our schools in a variety of ways.

A separate course in conservation might be offered on the senior high school level. Since we have stated that conservation education experiences are important for all youth, it would logically follow that such a course ought to be listed as a required subject. The resource units presented in this curriculum guide are of sufficient significance and scope for such a course.

Since many high school programmes are already pretty heavily weighted with required courses, there will be those who wish to handle the conservation education programme in other ways. One such way would be to introduce units of work concerned with conservation into already existing courses. For instance, the unit on Recreational, Scenic and Historic Resources might well be introduced into the social studies area in geography or history. Other units, such as Soil Resources or Mineral Resources, would seem to fit quite naturally into the science programme. This plan would serve equally well in elementary or high school. The materials presented in this book are well adapted to this kind of organization.

A third manner of introducing conservation education into the curriculum is to integrate portions of each unit into already existing courses which bear a close relationship to the field. For instance, certain portions of the unit of Forest Resources would be related closely to the content of the sciences. At the same time, there are implications for Agriculture in the same unit. Social Studies courses would be the natural setting for the consideration of the social implications of a policy of conservation and wise use of our forest resources or the lack of such a policy. All of the resource units in this bulletin lend themselves to this type of organization on the elementary and secondary levels.

Probably no one of these plans can be said to possess merits which recommend it above all others for use in our schools. It would seem important for each local system to choose the plan which would best meet its own particular needs and resources. Further, it seems that the introduction of a course in conservation, without some attention to integration of conservation education into closely related broad field areas, would fail to meet adequately the needs of the boys and girls and the society in which they live.

No matter what plan is adopted, careful cooperative planning by the school staff is necessary to insure a sequential development of such understandings, attitudes, appreciations, skills and behaviours as were conceived as the desirable outcomes of conservation education.

The Areas of Conservation

Although all of the resources considered in conservation are inextricably woven together in nature, practical considerations lead to a division of the field into five areas which have been treated in this resource guide. These areas are Soil Resources, Water Resources, Forest and other Vegetational Resources, Wildlife Resources, and Mineral Resources.

Because of its significance in this country, a sixth area, based in part upon a combination of the resources mentioned, has been given attention. This area is that of Recreational, Scenic and Historical Values.

While this book presents a resource unit for each of the significant areas, the teacher should lose no opportunity for presenting the abundant examples of inter-relationships whenever and wherever she can.

Its subject matter is the natural environment in which pupils live. It would be ironical indeed if conservation, with its consideration of ecology, the study of the organism in its environment, should fail to bring the boy and girl into fruitful interaction with their natural and social environments.

Conservation activities are more or less obviously socially significant and should therefore require little build-up with pupils or teachers. With soil erosion and depletion, for example, threatening our future food supply, what thinking individual can be indifferent.

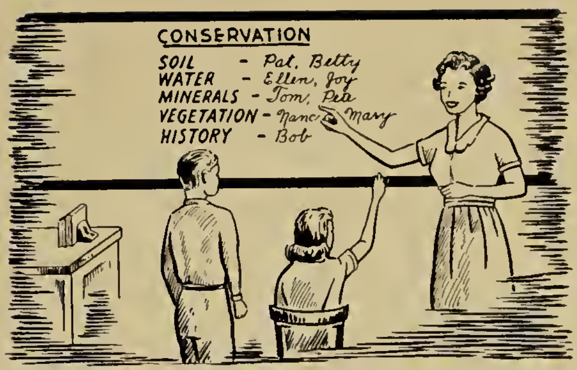
Being relatively new among subject fields, conservation has not yet become a vested interest with the necessity for maintaining obsolete methods and materials. First things can therefore be placed first: the educational welfare of children and the needs of society. Where such welfare requires conservation experiences, there these experiences may and should be provided. In this fashion, flexibility of planning may be encouraged, fresh first-hand experiences provided for boys and girls.

While conservation has these natural advantages, good teaching does not necessarily follow. It is still possible to make the teaching abstract and verbal. Great care should be exercised to see that conservation learning experiences maintain all their inherent freshness and vitality.

How Conservation Can Best be Learned

1. *The Learnings Should Begin With the Here and Now.* A careful survey of school and community conservation needs and resources should be made by teacher and pupils. This survey, if carefully planned, will not only reveal areas for conservation experiences, but will yield much information about individual pupil's backgrounds.

To carry out the survey, the teacher may begin by listing the important areas of conservation. According to the interest of pupils, the class may then be divided into as many committees or groups as there are conservation areas represented in the community. Through various forms of community research, contact with individuals, organizations, field trips, etc., each committee will catalogue the community conservation resources available for more intensive study.



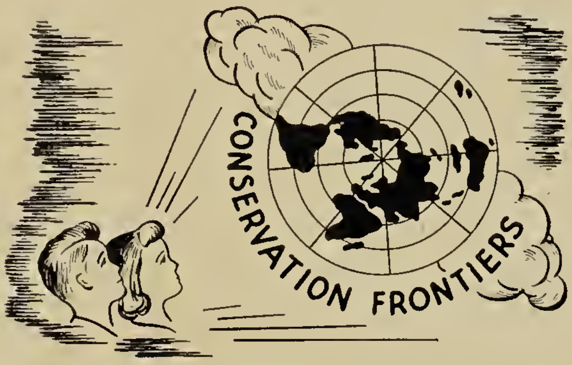
2. *The Learnings Must Grow Out of the Purposes of Boys and Girls.* Recent experimental studies in learning show that unless the pupil has a need for something and directs that need toward satisfaction (his purpose), learning does not take place. For learning to be purposeful to the learner, he should have a part in planning his learning experiences (teacher-pupil planning).

A survey of interests of pupils in the class may reveal a strong but divergent interest in various forms of wildlife. Through teacher-pupil planning individual pupils or small groups may select forms of wildlife for study in which they have a special interest. The form of study with which individuals or small groups wish to begin their study will be worked out from alternative possibilities provided by the teacher. For example, some groups may be able to study their selected wildlife in natural habitat, some in zoos, and some in individual collections.

3. *Learning Experiences Should be Concrete.* If we follow pupils' needs revealed through purposes and begin our study at home with local school and community needs, then the experiences are quite likely to be concrete, specific and individualized. Since, however, it is so easy in school learning to become abstract and verbal, constant vigilance should be directed toward making

learning concrete and practical. Field trips and conservation projects involving such activities as exploring, growing, rearing, collecting and constructing should take precedence over regular book learning activities. The latter, when necessary, will be incidental.

The group on the study of soils may begin its study by collecting various samples of different soils available in the community. These samples may be analyzed simply with a view to predicting their suitability for growing different plants. After this analysis a number of experimental growings of various plants in the various soils will serve to check on the preliminary analysis. Additional elements may be added to samples of soils according to their needs to show how worn-out soils may again become fertile.



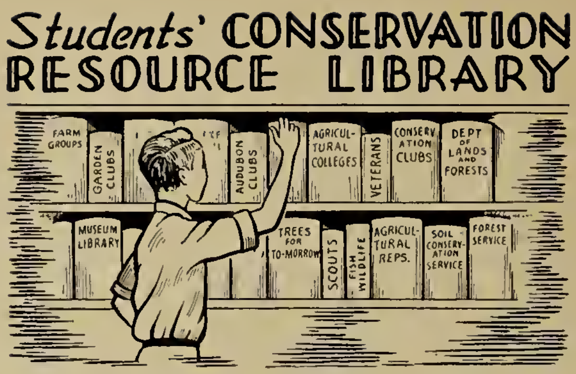
4. *Cooperative Planning and Pupil Purposing Should Take Into Account Concept Development and Concept Values.* The acquisition of rational concepts and broader and broader understandings are a major purpose sought by our most successful present-day teachers.

The desire to facilitate learning which embodies these cumulative concepts prompted the listing of these which have been carefully chosen, and which appear at the beginning of each of the six divisions developed in this book. These significant concepts should prove helpful to the teacher in his choice of desirable aims for achievement as well as in the selection of appropriate content for the learning desired.

The following suggestion is offered:

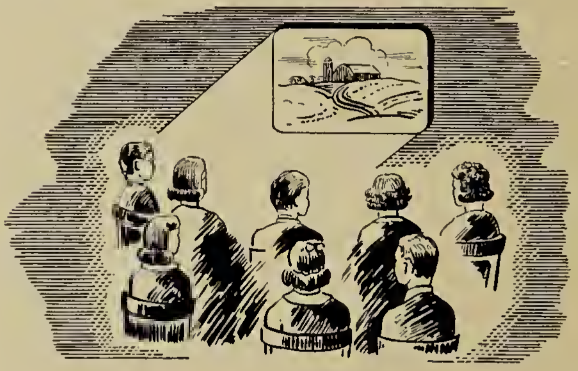
Concepts should be taught in a cumulative fashion, each growing naturally out of the learning process.

There should be no pressure to achieve these. Other concepts may be a part of their experience instead.



5. *All related community agencies should be surveyed and made available as resources.* The discovery of these agencies should naturally grow out of the original school and community survey. Farmers' groups, local conservation agencies, park groups, service organizations, federal organizations and others should all be drawn into cooperative working relationship with the school. The pupils will then have not only the satisfactions of fruitful learnings but also gain the social reinforcement growing out of actual contributions to the community.

Evidence of the value of this cooperative action on the part of all groups has given impetus to many improved communities. No one group could have gained such maximum results.



6. *All available teaching aids should be exploited.* Though it is desirable to make the learning experience as direct and concrete as possible, there will be of necessity some indirect learnings. These should always be related to direct learnings and made as vivid and real as possible. Visual and auditory aids will be helpful here. Motion pictures, slides, film strips, opaque projections, recordings, pictures and charts will and should supplement reading research. A good library should contain as much of the above types of materials as possible as well as suitable books, magazines and pamphlets.

Conservation of Our Soil

I. Significance of the Topic

A. SOIL IS OUR MOST VITAL RESOURCE

We are just waking up to the fact that we have been destroying our basic capital —our soil. Soil conservation is more than farming. It is a social and economic system that should enable man to use the soil and related resources continuously. To many people the thought is still new, that land can wear out. Farm people have known it as long as farming has been practiced, but even they have not realized that the land need not wear out if it is properly managed. If our soil is to be a continuous resource, it is of great importance that we plan for its wise use NOW as well as in the future. In our progress in this country we have achieved our present status of apparent wealth through the utilization and exploitation of our natural resources. As we stop and look back, we realize that soil—our most vital resource —was misused and mismanaged.

B. HUMAN WELFARE DEPENDS UPON WISE LAND USE

A practical viewpoint and application of soil conservation should come from a study of this basic resource. Wise use of soils is not an end in itself. In building a sound land use programme, human welfare is the first and most important consideration. Productive soils are necessary for economic security, healthy citizens and social stability. A reasonably stable society is our best guarantee of keeping for ourselves and our children the privileges and benefits of our democratic system of government. People—happy, healthy and secure in their way of life—are best fitted temperamentally to enjoy the beauty of forested hills, green fields, blue lakes and clear streams.

C. MUCH OF OUR TOPSOIL IS GONE

Soil can wear out at a disastrous rate. It washes away and blows when it is stripped of its cover of plants. Once the plants are removed, erosion sets in and the best soil—on top—begins to wash down hill or blow away as dust. While there is no accurate measure of loss caused by erosion the total, in terms of dust, storms, floods, mined farms and ranches, bankruptcy, and diminished wildlife, has been enormous.

D. VEGETATIVE COVER PROTECTS THE SOIL

Trees, shrubs, grasses and other plants form a vegetative cover that holds the soil in place. Where the vegetative cover is destroyed, soil is left unprotected. This fact is the key to soil conservation. As soon as a good plant cover is put back on the soil, erosion stops. Vegetation is nature's own weapon against soil erosion. Man has found no better one.

E. AN ULTIMATE GOAL OF SOIL CONSERVATION IS WISE LAND USE

Soil Conservation is essentially a matter of wise land use. On sloping lands suitable for cultivation such soil protection calls for contour farming, contour strip cropping, and contour terraces. Slopes too steep to be safe for cultivation should remain in permanent grass or trees. However, these are only some of the more conspicuous practices included in individual farm conservation plans. About fifty different soil-saving and soil-building measures are used today. They include such things as grass waterways, pasture renovation, drainage, and controlled grazing. The needs and capabilities of each acre of land determine the use and protection needed. This acre-by-acre treatment of our land resources is the basis of our soil conservation programme today.

F. SOIL CONSERVATION SERVICES THROUGH LOCAL DISTRICTS CONTRIBUTE MUCH TO SOLVE SOIL CONSERVATION PROBLEMS—FOR INFORMATION WRITE TO YOUR PROVINCIAL OR STATE DEPARTMENT OF AGRICULTURE.

II. Outline of Content

A. WHAT WE SHOULD KNOW

1. Soil—our basic resource
2. Natural processes in soil building
3. Weathering of inorganic materials
4. Parent materials in soil composition
5. Time—a factor in soil composition
6. Soil divided into layers (Top Subsoil —Parent material)
7. Forces constantly at work on soil changes (The soil forming process. Physical-Biological-Chemical)
8. Movement of soil
9. Humus and mineral plant food
10. Source of water in soil
11. Movement of soil water
12. Effects of rain and temperature on soil surface
13. Plant food elements in the soil
14. Land obtained for cultivation
15. Meaning of soil conservation
16. Soil definition

B. CAUSES OF PROBLEMS

1. Wrong agricultural methods
2. Soil losses by water and wind
3. Soil losses by leaching
4. Exploiting type of ownership
5. Practices of tenants
6. Wrong cropping practices
7. Loss of fertility by not replacing soil elements
8. Lack of awareness of the seriousness of erosion
9. Use of submarginal lands

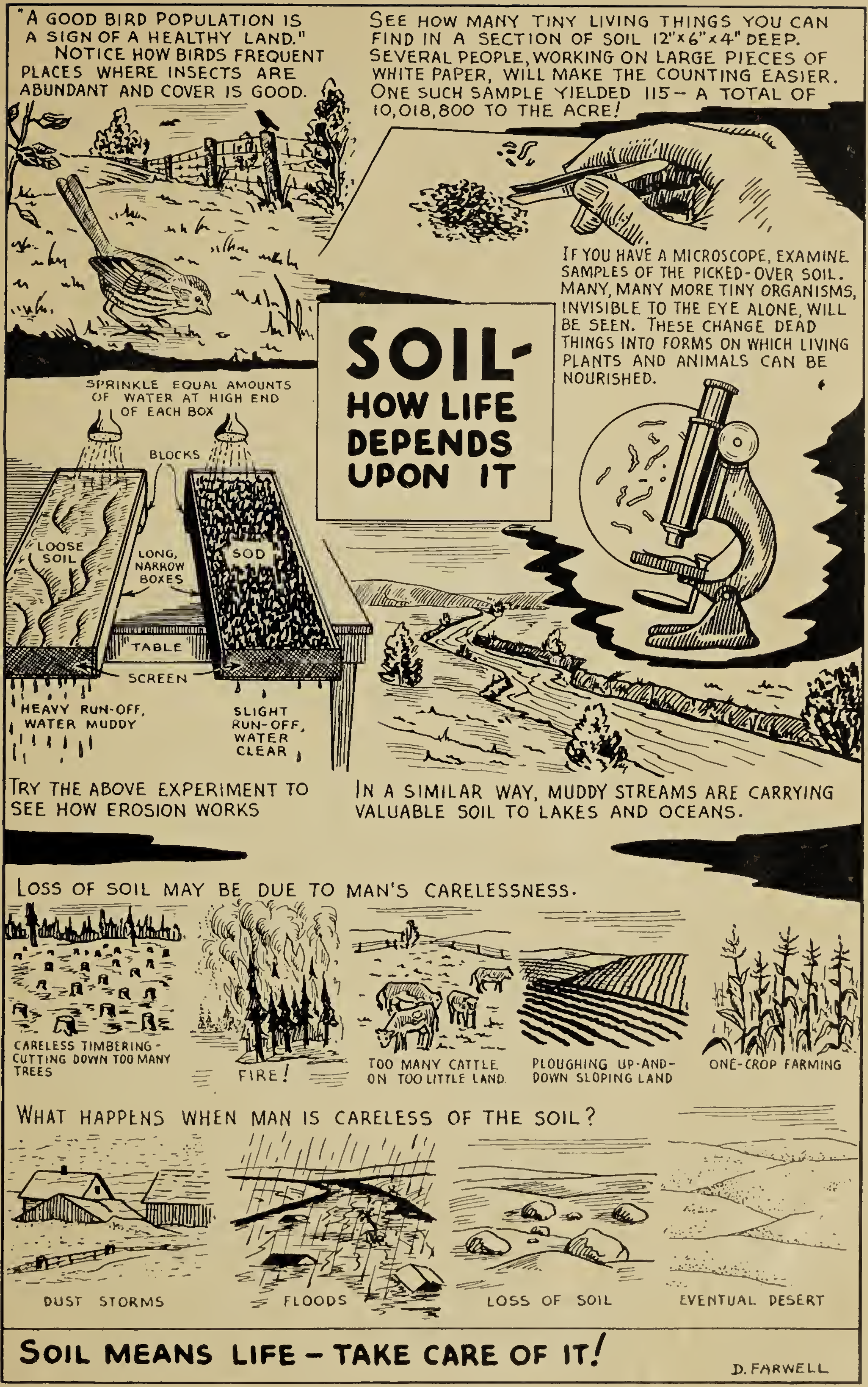
C. SOLUTIONS OF PROBLEMS

1. Land planning and zoning
    a. Alternate land use (Forest, Agricultural, Recreational land use)
    b. Using land's natural productive capacity
    c. Soil Conservation Districts and Services
    d. Farm Conservation Planning
2. Maintaining soil fertility
    a. Green manuring crops
    b. Use of barnyard manure
    c. Use of mineral fertilizer
    d. Systematic crop rotation
3. Preventing soil erosion through the use of modern techniques
4. Restoration of proper soil cover

III. Possible Outcomes

A. UNDERSTANDINGS

1. An understanding of the nature of soil and how it contributes to the welfare of living things.
2. An understanding of how soils have been misused, and how such abuse contributes to the weakening of our democratic institutions and to poverty.
3. An understanding of how soil, water and vegetation are interdependent, and how all are essential to the welfare of man.



SOIL- HOW LIFE DEPENDS UPON IT

"A GOOD BIRD POPULATION IS A SIGN OF A HEALTHY LAND." NOTICE HOW BIRDS FREQUENT PLACES WHERE INSECTS ARE ABUNDANT AND COVER IS GOOD.

SEE HOW MANY TINY LIVING THINGS YOU CAN FIND IN A SECTION OF SOIL 12"×6"×4" DEEP. SEVERAL PEOPLE, WORKING ON LARGE PIECES OF WHITE PAPER, WILL MAKE THE COUNTING EASIER. ONE SUCH SAMPLE YIELDED 115 – A TOTAL OF 10,018,800 TO THE ACRE!

IF YOU HAVE A MICROSCOPE, EXAMINE SAMPLES OF THE PICKED-OVER SOIL. MANY, MANY MORE TINY ORGANISMS, INVISIBLE TO THE EYE ALONE, WILL BE SEEN. THESE CHANGE DEAD THINGS INTO FORMS ON WHICH LIVING PLANTS AND ANIMALS CAN BE NOURISHED.

SPRINKLE EQUAL AMOUNTS OF WATER AT HIGH END OF EACH BOX
BLOCKS
LOOSE SOIL
LONG, NARROW BOXES
SOD
TABLE
SCREEN
HEAVY RUN-OFF, WATER MUDDY
SLIGHT RUN-OFF, WATER CLEAR

TRY THE ABOVE EXPERIMENT TO SEE HOW EROSION WORKS

IN A SIMILAR WAY, MUDDY STREAMS ARE CARRYING VALUABLE SOIL TO LAKES AND OCEANS.

LOSS OF SOIL MAY BE DUE TO MAN'S CARELESSNESS.

CARELESS TIMBERING - CUTTING DOWN TOO MANY TREES
FIRE!
TOO MANY CATTLE ON TOO LITTLE LAND.
PLOUGHING UP-AND-DOWN SLOPING LAND
ONE-CROP FARMING

WHAT HAPPENS WHEN MAN IS CARELESS OF THE SOIL?

SOIL MEANS LIFE – TAKE CARE OF IT!

D. FARWELL

4. An understanding of principles and practices which will insure for people the greatest good for the largest number over the longest period of time.
5. An understanding that the soil is the richest heritage with which man is endowed.
6. An understanding that basically, soil is made up of organic and inorganic materials, and that these are constantly undergoing changes.
7. An understanding that soil is normally composed of more or less distinct layers, which form the soil profile. These layers differ in colour, texture, structure, water-holding capacity, organic content and fertility.
8. An understanding that the formation of soil depends upon the action of natural forces constantly at work over a long period of time.
9. An understanding that soil is the reservoir which holds water.
10. An understanding that the texture of soil is determined by the proportion of particles of varying sizes.
11. An understanding that physical, chemical and biological agencies are constantly at work making plant food in the soil.
12. An understanding that man's actions have developed conditions which accelerated damage to the soil and impaired its fertility.
13. An understanding that man can control erosion by using some of nature's methods and by practicing wise land use procedures.
14. An understanding that poverty, suffering and soil depletion have resulted from the misuse of land and from the settlement of people upon poor land.
15. An understanding that correct land use with a purpose of passing the land on unimpaired or improved for future generations is desired.
16. An understanding that man must adjust himself to right land use through zoning and planning.

E. ATTITUDES AND APPRECIATIONS

1. An appreciation of our soil heritage.
2. An interest in soil conservation literature, such that students will utilize well-founded facts in the promotion of sound soil conservation practices.

IV. Inventory of Possible Activities

A. INITIATORY ACTIVITIES

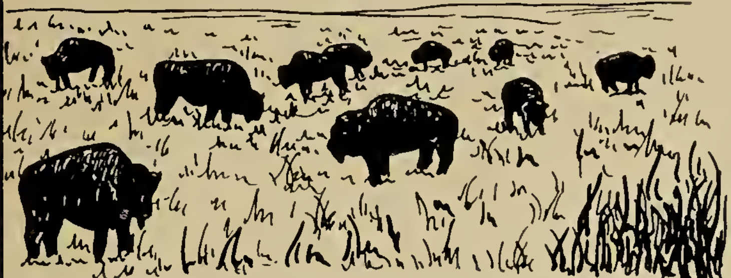
1. Collect soil samples from different areas for later study of composition; water holding capacity; percent of organic and mineral matter.
2. Make field trips to find soils and soil formations. View soil profiles at roadside cuts and note differences between topsoil and subsoil; note differences between soils in forests, in pastures, in cultivated fields, and in gardens.
3. Find evidences of soil erosion, weathering and leaching.
4. Interview old settlers of the community about natural conditions when the community was first settled and make reports to the class on the interviews.
5. Find out why farms in your locality have been abandoned.
6. Have the county agricultural representative talk to the class about the local soil improvement programme.
7. Make a survey of the library to determine the materials available on soils and soil conservation.
8. Familiarize yourself with the various agencies producing materials and literature on soil conservation.
9. Start a scrapbook to include soil improvement activities in your community.
10. Survey the table of contents of available books and pamphlets to find major emphasis centres considered in those materials.
11. Visit farms where commercial fertilizers are used.
12. Collect samples of commercial fertilizers.

B. ACTIVITIES AND DISCUSSIONS

1. Developmental Activities.
   - a. List basic commodities under food, clothing and shelter to show how many of these are products of the soil.
   - b. Arrange a panel discussion to consider natural processes—the following division may prove helpful: (1) Physical forces, (2) Biological forces, (3) Chemical forces.
   - c. Bring in evidence of weathering and indicate how weathering helps to build soil—which weathering forces specifically bring about the changes in evidence.
   - d. Review conservation articles and conservation books which may be available to obtain evidences of the time factor in soil production.

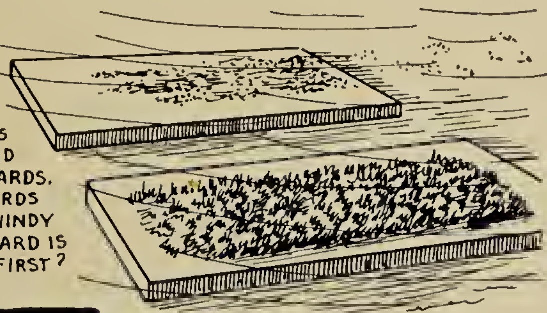
We Need Our GRASSLANDS

PLAINS AND PRAIRIES WERE ONCE COVERED WITH WILD GRASSES. HERDS OF BUFFALO ROAMED THE RANGE.



TO-DAY, PRAIRIES SUPPORT SUCH MAN-PLANTED GRASSES AS WHEAT, CORN, AND BARLEY. CATTLE HAVE TAKEN THE PLACE OF THE BUFFALO.

THIS EXPERIMENT SHOWS HOW GRASSLANDS HELP PREVENT LOSS OF SOIL BY THE WIND



PLACE ABOUT EQUAL AMOUNTS OF DRY SOIL AND DRY SOD ON BOARDS. PUT THE BOARDS OUTSIDE ON A WINDY DAY. WHICH BOARD IS BLOWN CLEAN FIRST?

GRASS IS A SOIL BUILDER AND A SOIL PRESERVER:

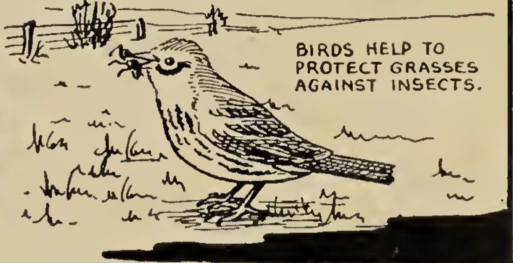
NEW ROOTS BIND THE SOIL TOGETHER.

OLD ROOTS DECAY AND FERTILIZE THE SOIL:

WILD ANIMAL LIFE HAS ITS VALUE TO GRASSLAND AREAS.

COYOTES AND HAWKS HELP TO KEEP DOWN THE NUMBERS OF BURROWING ANIMALS

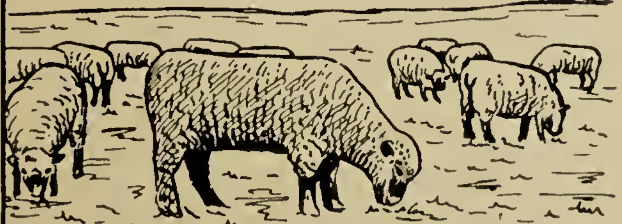
BURROWING ANIMALS, TO SOME EXTENT, HELP TO MIX, LOOSEN, DRAIN, AND FERTILIZE THE SOIL.



BIRDS HELP TO PROTECT GRASSES AGAINST INSECTS.

GRASSLANDS CAN BE SPOILED BY HAVING TOO MANY CATTLE OR SHEEP ON A RANGE.

CATTLE-PATHS TO WATER MAY FORM GULLIES, AND EROSION MAY SET IN.

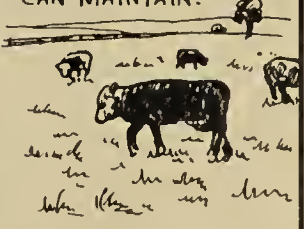


SHEEP GRAZE CLOSE TO THE GROUND. TOO MANY ARE APT TO KILL OUT THE GRASS.

WHAT CAN BE DONE TO PROTECT OUR GRASSLANDS?

IN POOR SOIL, PLANT TOUGH GRASSES UNTIL THE SOIL IS GOOD ENOUGH TO SUPPORT MORE EDIBLE KINDS.

KEEP ONLY THE NUMBER OF CATTLE OR SHEEP THAT THE LAND CAN MAINTAIN.



BEWARE OF PRAIRIE FIRES!

WHAT OTHER WAYS CAN YOU SUGGEST?

D. FARWELL

e. Plan a field trip to view a soil profile—roadside banks showing different layers of soil, build a soil profile for classroom use.
f. Measure the depths of soil horizons in an old cemetery and compare with those of nearby cultivated land. Make observation, record data, and draw conclusions. (A soil horizon is one of the layers of a soil profile.)
g. Plan a field trip to find examples of various types of soil erosion: (1) gulley erosion, (2) sheet erosion, (3) stream bank erosion, (4) wind erosion.
h. If possible, find what has been done by way of preventing such type of erosion noted on the land-area visited.
i. Make a field trip to study other conservation practices on a farm.
j. Collect run-off water and determine what it carries.
k. Make or find pictures showing "before and after" erosion control and mount them. Label each properly.
l. Test different soils for rate of capillary action.
m. Test different soils for water absorbing and water holding capacity.
n. Test a sample of soil for organic matter. Weigh the sample, dry it, burn it, weigh it again to determine weight of organic material.
o. Test different types of soil for adhesion.
p. Observe the cutting power and carrying capacity of water flowing at different rates.
q. Observe different soils for texture. Use hand lens.
r. Obtain several flower pots which may be used for experimental purposes. Fill the first pot with poor soil (subsoil). Fill the second pot with subsoil to which some organic matter has been added. Fill the third pot with subsoil to which commercial fertilizer has been added. Fill the fourth pot with subsoil to which both organic matter and commercial fertilizer have been added. Plant several wheat kernels in each pot, giving the pots equal care and attention. Note differences in plant growth and draw conclusions.
s. Make a diagram to explain the movement of water in the soil and continue by following the movement of water up through the plants into the atmosphere. Can you complete the water cycle?
t. Plan a field trip to find evidences of the effect of rain and temperature on the soil surface. Note especially the effect of freezing and thawing on the banks of streams and lakes and also the effect of drying and resultant cracking on low areas of ground.
u. Have each member of the class take samples of soil from their garden or farm and test these for plant food elements: (1) How should samples be taken? (2) Where should samples be taken? (3) How should they be labelled? Why? (4) How may the results be used to aid in soil improvement and conservation?
v. Illustrate the various ways through which land may be brought under cultivation. Were these land policies in keeping with the greatest good over the longest period of time?

2. Discussion Topics: (These topics parallel foregoing experiences)

a. Discuss the extent to which the local standard of living is dependent upon soil productivity.
b. How is the land of the neighbourhood changing, and to what is this change attributable?
c. Describe the land of your locality at the time of the arrival of the early settlers.
d. What were the primary purposes of the early settlers and how did these purposes affect the early treatment of the soil?
e. To what extent has the productivity of our soil been reduced in the past through questionable methods of management?
f. What factors are constantly changing the earth's surface (rain, wind, ice, snow, plants, animals, and man)?
g. Give the results of your study of parent-materials in soil formation and composition. (Obtain results from direct observation as well as from reading.)

h. Discuss differences in soil using collections made for illustrative purposes.
i. Give quotations from soil authorities to indicate the time required for soil formation.
j. How does the texture of the soil affect capillary action and water holding capacity? What is the value of this information to agriculture?
k. Does water penetrate all soil at the same rate? What are the implications of soil absorption for crop production?
l. Make a blackboard drawing to illustrate the water cycle, and explain characteristics to the class.
m. How does the character and quality affect plant growth? Note—In this discussion two characteristics should be emphasized: (1) Plants most suitable for various kinds of soil, (2) Importance of soil quality to efficient production.
n. What kinds of fertilizers are available for soil improvement?
o. Discuss factors which influence the rate of erosion.
p. How can the soil of our community be more effectively conserved?
q. What private and governmental agencies are contributing to soil conservation? Explain.
r. Obtain information on the dust storms of the 1930's and present such information to the class.
s. To what extent has erosion reduced land values in your community?
t. List and discuss values of erosion control practices.
u. Discuss the importance of crop rotation to soil productivity and erosion control.
v. Present a 3-4-5 year crop rotation plan and justify your choices.
w. What is the value of plowing under green crops?
x. How does the productivity of farms upon which dairying or beef raising has been carried on compare with those devoted exclusively to grain farming?
y. Discuss a practical method of maintaining the fertility of a farm. (1) Name and describe the general type of fertilizer available for soil use. (2) How is the government assisting farmers in maintenance of their soils at the present time? (3) Have three or four students prepare a round-table discussion on the farm tenancy problem and its relation to the soil. (4) Give a talk to your class on the method employed in describing the land for titles, deeds, etc. Your town clerk will be glad to assist you in your project.

C. CULMINATING ACTIVITIES

1. Assume that four or five of your class members are members of your county council and are delegated the responsibility of mapping out a soil conservation programme for your county with county funds. Indicate what the group should include in such a programme.
2. Choose and briefly sketch a farm of your community and make specific recommendation as to its most desirable care and use.
3. Bring to class several plants. Include in the group some clean tilled plants such as corn, beets, etc., and also some plants which are not cultivated, such as wheat, clover, etc.,—discuss the difference in the roots of the two groups and how they would likely affect erosion.
4. Arrange a round-table discussion in which one member of the group will represent each of the following:
   a. The Conservation Department
   b. The county agricultural representative
   c. The local farmer
   d. The local school board

   Have each member of the group present what the unit of government which he represents can do to further agricultural values through a soil conservation programme. Concentrate upon specific types of effort rather than upon generalities.
5. Prepare a play on the topic, "Soil, the Nation's Greatest Heritage." Present the play to the Home and School Association, or community organization.
6. Discuss ten losses resulting from soil erosion.
   a. Decreased food production.
   b. Increased floods taking toll of life and property.
   c. Dust storms rendering areas unfit for use.
   d. Periodic crop failures.
   e. Decreased food for wild game.
   f. Muddy streams unfit for fish.
   g. Silted reservoirs rendering hydro-electric power useless.

   - h. Decline of industries, and decay of cities.
   - i. Loss of plant food and added submarginal land.
   - j. Bankrupt farmers, migrating populations, poverty and decadence.

7. Bring to class samples of soil from the top of a sloping field which has been ploughed, from a woods where the leaves are thick, from a valley where soil washes in, and from a roadside bank. Study the differences in colour and feel of the various soils. Which appears the richest? Draw conclusions.

V. Evaluation Suggestions

A. Evaluate on the basis of the twelve major concepts for soils in this unit.

B. Does the pupil show growth in soil conservation understandings, and does he recognize the importance of conservation to the maintenance of a desirable standard of living, and, in fact, to human survival?

C. In addition to a desirable conservation background, has the student become inspired to do something about conservation?

D. Does the pupil evince a desire to gain more information about conservation?

E. Has the unit contributed to habits which involve:
   - a. Careful observation and study
   - b. Critical thinking
   - c. The arrival at valid conclusions

F. Does the student show a tolerant attitude toward the many kinds of worthwhile effort now underway in conservation?

Water Conservation

I. Significance of the Topic

A. ALL LIVING THINGS ARE DEPENDENT UPON WATER

Areas near springs, brooks, streams, rivers, lakes or oceans have, since his first appearance on earth, been the location of man's homes. People recognize the necessity of water for their existence and for the plants and animals upon which they rely for food. During the wanderings of early man the distribution and supply of water were important factors which determined, as they do today, whether his life would be poor or prosperous, whether his crops would flourish or perish, or whether his stay would be short or long in duration. The water supply also is one of the determiners of the abundance and type of plant life which make possible the provision of much of the food supply for wild life. Gregarious by nature, man congregates in the areas where soil and water work together to provide the essentials which are necessary for an abundant supply of living things.

B. THE RIGHT USES OF WATER

Even though three-fourths of the earth's surface is covered with water, conservation minded people today are concerned about its misuse. Water is unique among the earth's resources in that it is constantly returning through the process of evaporation and precipitation. While the overall quantity is not noticeably diminished, man's unwise use in certain areas does greatly affect the local supply. Throughout much of the country the water table has declined steadily and in some places seriously. Water properly managed can render repeated services in many ways, all of which directly concern the general welfare of people.

C. WATER CONTRIBUTES TO OUR HEALTH

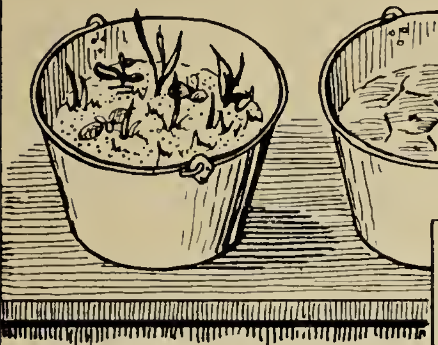
In daily life some things are so commonplace that we become unconcerned about them. Water is one of these things. Yet this resource to which we pay so little attention is the life blood of the earth. It is necessary to the production of the food, to the conveyance of food and waste, to the regulation of body temperature, and to the cleansing of both the body and environment of man. The use of water for recreational purposes contributes greatly to man's physical, mental, and emotional health.

D. WATER BELONGS TO EVERYBODY

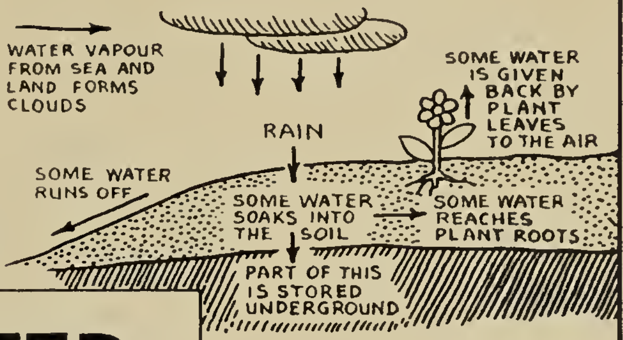
Regardless of who has responsibility for the management and control of our water resources, the ultimate motive must be the greatest good for the largest number over the longest period of time. The development of hydro-electric plants for our increased use of electricity, the converting of many arid regions to agriculture through irrigation, the

WATER- LIFE-BLOOD OF THE EARTH

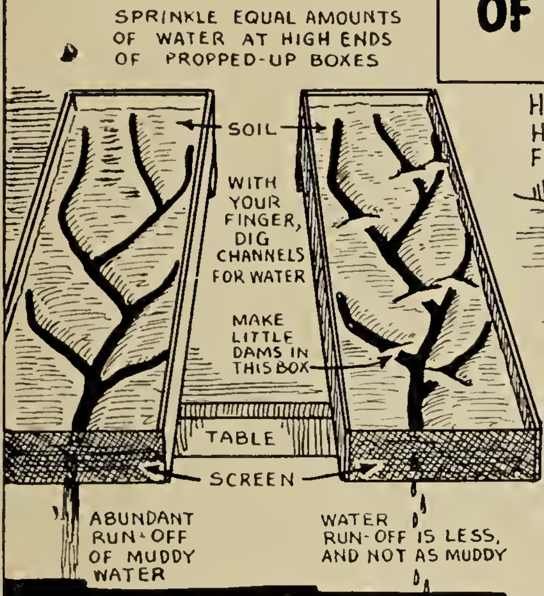
PLACE SIMILAR AMOUNTS OF SOIL OR SOD IN TWO PAILS. WATER THE SOIL IN ONLY ONE OF THE PAILS. NOTE THAT, IN THE OTHER PAIL, GROWING THINGS DRY UP AND DIE. WATER IS NECESSARY!



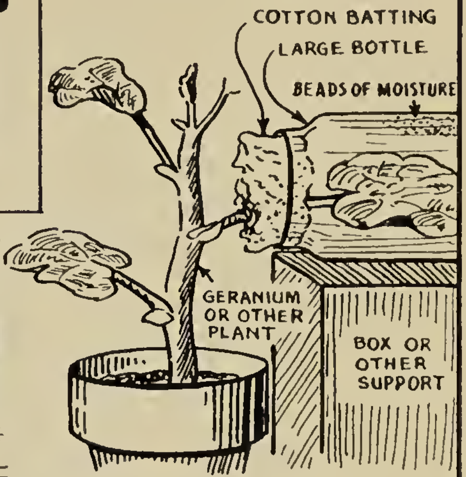
THIS LITTLE DIAGRAM ILLUSTRATES THE WATER CYCLE. WRITE THE STORY OF A DROP OF WATER.


WATER VAPOUR FROM SEA AND LAND FORMS CLOUDS
RAIN
SOME WATER IS GIVEN BACK BY PLANT LEAVES TO THE AIR
SOME WATER RUNS OFF
SOME WATER SOAKS INTO THE SOIL
SOME WATER REACHES PLANT ROOTS
PART OF THIS IS STORED UNDERGROUND

YOU CAN SHOW THE VALUE OF FLOOD CONTROL:

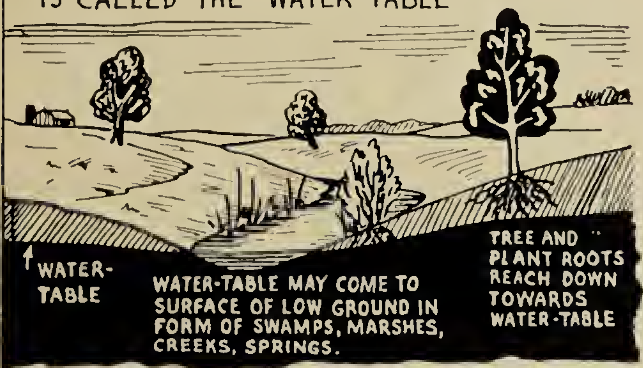

SPRINKLE EQUAL AMOUNTS OF WATER AT HIGH ENDS OF PROPPED-UP BOXES
SOIL
WITH YOUR FINGER, DIG CHANNELS FOR WATER
MAKE LITTLE DAMS IN THIS BOX
TABLE
SCREEN
ABUNDANT RUN-OFF OF MUDDY WATER
WATER RUN-OFF IS LESS, AND NOT AS MUDDY

HOW DO BEAVER DAMS HELP TO CONTROL FLOODING WATERS?



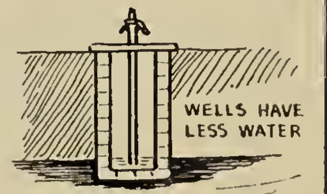
HERE IS AN EASY EXPERIMENT TO SHOW THAT LEAVES GIVE OFF MOISTURE. IMAGINE HOW MUCH WATER THE LEAVES IN A FOREST GIVE OFF, AND THEREFORE HOW MUCH THE TREE ROOTS NEED TO TAKE IN!

SOME WATER IS STORED UNDERGROUND. THE UPPER LEVEL OF THIS RESERVOIR IS CALLED THE "WATER-TABLE"


WATER-TABLE
WATER-TABLE MAY COME TO SURFACE OF LOW GROUND IN FORM OF SWAMPS, MARSHES, CREEKS, SPRINGS.
TREE AND PLANT ROOTS REACH DOWN TOWARDS WATER-TABLE

ADD TO THIS SERIES OF DRAWINGS SHOWING THE RESULTS OF A LOW WATER-TABLE:

STREAMS LESS FULL



WELLS HAVE LESS WATER

PLANTS DIE

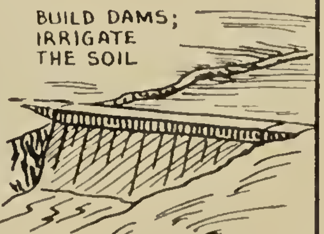
SOIL DRY—LIKELY TO BE BLOWN AWAY

WATER RUN-OFF CAN BE SLOWED DOWN, AND THE MORE SLOWLY WATER TRAVELS, THE MORE GOOD IT DOES ALONG THE WAY.

PLOUGH ACROSS SLOPING LAND

PLANT MORE TREES

PLANT DEEP-ROOTED CROPS, SUCH AS ALFALFA



BUILD DAMS; IRRIGATE THE SOIL

D. FARWELL

great use of water for wildlife production and recreational development, all indicate the multiplicity of uses which make this resource of such great significance to everyone. To gain an understanding of the entire scope of water conservation, adults and students must be made to see the basic relationship between it and the conservation of our forests, soils, wildlife, and recreational resources and how each of these affect our daily lives.

II. Outline of Content

A. SOURCES OF OUR WATER SUPPLY

1. Lakes
2. Wells
3. Springs
4. Artesian wells
5. Streams
6. Oceans

B. THE USES OF WATER

1. To support human and animal life.
2. To support plant life.
3. Water used for agricultural purposes and irrigation.
4. Water used for the generation of power.
5. Water as a means for transportation.
6. Water as a medium for the removal and purification of waste.
7. Water as a recreational asset.
8. Water as a determiner of political boundaries.

C. THE WATER OR HYDROLOGIC CYCLE

1. A continuous process.
2. Sources of atmospheric moisture.
    - a. Evaporation
    - b. Transpiration
    - c. Respiration
3. Precipitation
4. What happens to rainfall?
    - a. Runoff
    - b. Evaporation
    - c. Absorption
    - d. Percolation

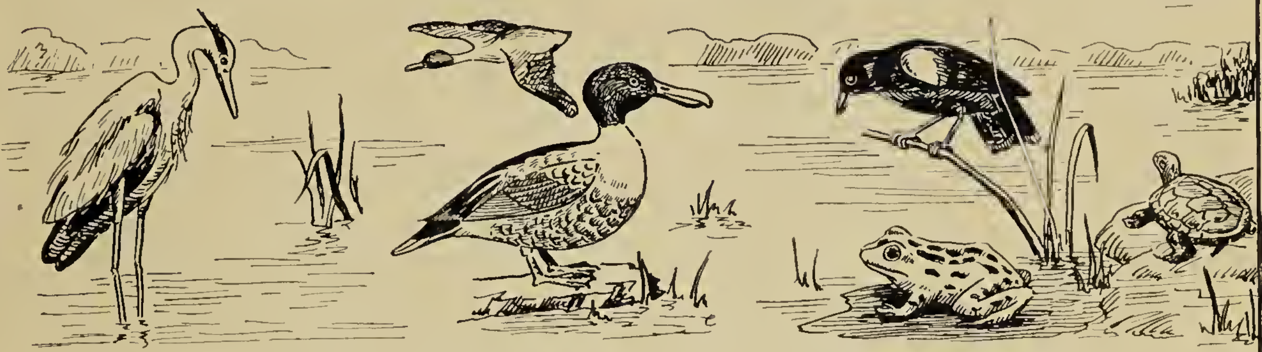
D. PROBLEMS OF OUR WATER SUPPLY AND THEIR SOLUTION

1. Floods and Flood Control
    - a. Flood destruction
    - b. Conditions affecting floods (1) Rainfall, (2) Slope, (3) Soil types and rock structures, (4) Lack of vegetation (over-grazing—fire—overcutting of trees, etc.)
    - c. Why flood damage is increasing (1) Uncontrolled run-off water, (2) Poor land practices.
    - d. Flood control (1) Correct land use (contouring, stripping, terracing, etc.), (2) Forests and other vegetation, (3) Correct land use, (4) Protection levees, (5) Spillways and floodways, (6) Retarding basins, (7) Storage reservoirs.
    - e. Flood control practices in this country.
    - f. The responsibility for flood control lies in the cooperation of individuals, counties, provinces, and nations.
2. Low Water Conditions
    - a. Importance of maintaining the flow of streams during dry seasons for water supply, vegetation, etc.
    - b. How we can increase the flow of streams.
    - c. What is being done in your area to maintain uniform stream flow?
3. Water Pollution
    - a. Causes of water pollution.
    - b. Effects of water pollution.
    - c. How can water pollution be reduced or eliminated? (1) Analysis of water for purity, (2) Modern treatments for the disposal of industrial wastes and sewage.
4. The Quality of Water—A Factor in the Use Made of It
    - a. For industrial purposes.
    - b. For human use.
    - c. Purification of water—(1) Filtration, (2) Aeration, (3) Chlorination.
5. Conservation of Water Power
    - a. Early uses of water power.
    - b. Importance of our power resources.
    - c. Why only a small portion of our potential power is used.
    - d. Some local sources of power.
    - e. Some existing sources of power in this country.
6. Our Waterway Resources
    - a. The use of the Great Lakes.
    - b. Recent developments in the use of rivers and their tributaries.
    - c. Economic value of water transportation.
    - d. Use of canals.
    - e. Present and past use of waterways in this country.
7. Water for Recreation.
    - a. Bathing, boating, fishing and hunting.

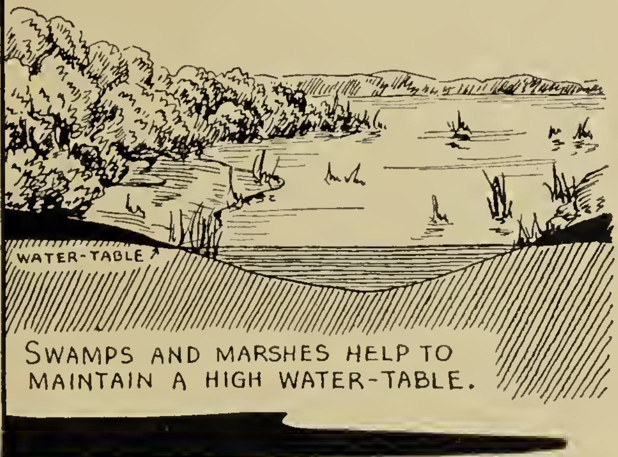
A SWAMP IS A WET. WOODED AREA.

A MARSH IS A WET, TREELESS AREA.

SWAMPS and MARSHES --

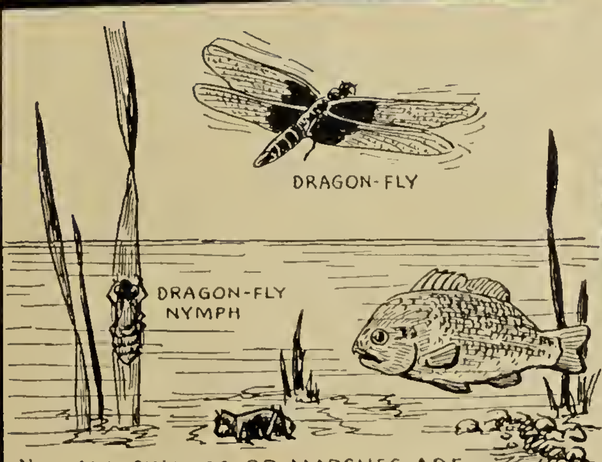


SWAMPS AND MARSHES ARE NECESSARY FOR THE PRESERVATION OF MANY FORMS OF WILD LIFE.



SWAMPS AND MARSHES HELP TO MAINTAIN A HIGH WATER-TABLE.

SEARCH FOR FORMS OF LIFE IN THE MARSH OR SWAMP AS WELL AS AROUND IT



NOT ALL SWAMPS OR MARSHES ARE BREEDING-GROUNDS FOR MOSQUITOES. OTHER FORMS OF AQUATIC LIFE MAY FEED ON THE MOSQUITOES AND THEIR LARVAE

SOME SWAMPS AND MARSHES PROVIDE A LIVELIHOOD FOR THE TRAPPER, AND RECREATION FOR THE FISHERMAN.

D. FARWELL

E. PLANNING FOR WATER CONSERVATION

1. The importance of correct land use.
2. The influence on watershed by forests and other vegetation.
3. The consideration of the entire drainage basin in planning.
4. The questions of legal control as a problem area.

III. Possible Outcomes

A. KNOWLEDGE AND UNDERSTANDINGS

1. Knowledge of the availability of water in the locality, and the various uses to which it is put.
2. Knowledge as to man's dependence upon water for his life and living—transportation, power, fishing, consumption, etc.
3. Knowledge as to the relation of water to other natural resources.
4. Knowledge as to stream care and protection to safeguard streams from floods and pollution.
5. Knowledge of plans and proposals for wider use of streams for power, navigation and recreation.

B. ATTITUDES AND APPRECIATIONS

1. An appreciation of the contribution of water to the early exploration and development of the country.
2. An appreciation of the contribution which water makes to man's recreational life.
3. An appreciation of lake and river beauty in its many manifestations.
4. An appreciation of man's custodial responsibility in reference to our lakes and streams.

IV. Inventory of Possible Activities

A. INITIATORY ACTIVITIES

1. Make a study of the water resources of your community, and draw a map of the area locating lakes, streams, dams if any, water power plants, etc.
2. Make a survey of your library to locate books, magazines, newspaper articles, etc. that contain information which will be helpful in your conservation study.
3. From your scanning of books, articles, etc., related to water conservation, list a dozen or more major headings under which water conservation values might well be studied.
4. Interview early settlers to gain information as to how the water table has changed during past years. Have dug wells gone dry? Have lakes lowered? etc.
5. Have a representative of the class write for bulletins on—rural water installations —rural sanitary sewage disposal plants —helps in developing drainage plans and programmes.
6. Visit a farm of the locality upon which the farmer has done work to conserve water, moisture, etc. Ask him to explain why and how his protective work was done.
7. Start a scrapbook on the conservation of water resources.
8. Go out after a heavy rainfall to observe evidences of washing. Try to think of ways and means of eliminating such destruction.
9. Have each pupil start an anecdotal record of what he has done about water conservation. This should be continued throughout the work, and if possible after he completes the work in class.

B. ACTIVITIES AND DISCUSSIONS

1. Developmental Activities
   - a. Visit an urban water supply plant, obtain information as to its source and distribution of water, and explain its service using blackboard drawings for illustrative purposes.
   - b. Make drawings to illustrate the various types of water systems in rural homes. (1) The gravity system with suspended tank, (2) The shallow well type, (3) The deep well type.
   - c. Make a drawing of a deep well pump, and explain its operations.
   - d. From a weather map, explain the significant elements included upon it. Explain particularly the high and low areas, and the effect of air movement to higher altitude and higher latitude.
   - e. Make a drawing to illustrate the various movements of moisture and water in the water cycle.
   - f. Have the class, or a committee of it visit a water power plant and explain its operation.
   - g. Have students perform various experiments to show evaporation and condensation.
   - h. Show through experimentation the differences between hard and soft

water. Explain the value of evaporation and condensation to land, plant, and animal life.

i. Make a diagram of a water softener, and explain its operation.

j. Plan a programme for the purification of water of your home and community.

k. Visit a publicly owned city or village sewage disposal system, and with illustrative drawings, explain its operation.

l. Develop a chart with illustrative pictures showing the functions and operation of a power development such as Niagara.

m. Develop a balanced aquarium in the classroom, and show how water, fish and vegetation may be kept in balance.

n. Show by diagram the engineering features developed on an important local river to improve the situation in reference to water.

o. Study your locality, and indicate characteristics conducive to floods, and those which serve as preventive and control features.

p. Draw the section of Canada and the U.S. which includes the Great Lakes. Indicate specifically the location of the proposed deep-sea channel. Explain the differences of opinion in reference to this proposed project.

q. Make a diagram upon which you locate the arrangement of rock strata and soil layers which make possible an artesian well. Locate the place or places where, through drilling, one might be obtained.

r. Write the story of a river. Tell of its source in high lands; how it passes through cities, and its contribution to each; of the life which it maintains; of the unwise treatment which it receives along the way, and of the extended use which could be made of it with proper treatment. Indicate where it flows out into the sea, and the result of the change of its movement at its mouth.

2. Discussion Questions

a. Discuss the water resources which are available in your community as to (1) adequacy, (2) use, (3) treatment to assure long range effectiveness.

b. Review the sources of water supply, and indicate those which are most likely to be free from contamination.

c. How did the streams and lakes contribute to the life of the early settlers?

d. Explain the formation of frost, snow, hail, rain and dew.

e. Explain the hydrologic cycle.

f. In what ways has water been wasted in the past, and in what ways do we continue wasteful practices?

g. Why has the use of our streams for navigation fallen off so greatly in recent years?

h. Explain why it is of value to keep streams at an even flow?

i. Explain the relation between forests and the even flow of streams?

j. Flood damage is said to be on the increase. Explain why.

k. Has civilization increased or decreased the amount of water stored in the earth? Explain.

l. What flood control measures are being taken by the province? by the nation? How can we contribute to the movement?

m. Explain ways in which water is being polluted at the present time, and tell of its disastrous results.

n. Suppose you were running for a legislative office; list the planks which might be included in your platform for the elimination of pollution.

o. What characteristics should good drinking water for household use possess, and how can it be improved under certain circumstances for domestic use?

p. Explain the early uses of water power, and how engineering has helped to improve its uses.

q. Why is the use of water power so limited at the present time?

r. Give a report on existing sources of power in this country, and if possible, the extent to which the source is now contributing power.

s. Give a report on local sources of power.

t. Discuss the use of the Great Lakes for transportation purposes.

u. Explain recent engineering developments which enhance the use of a river for commercial purposes.

v. Discuss the contribution which water makes to the tourist industry in this country.

w. Do you favour Federal Government participation in water power projects? Explain.

C. CULMINATING ACTIVITIES

1. Arrange a panel discussion in which one member represents agriculture, another industry, a third a recreation director, and a fourth, commerce. Have them discuss the question, "What does a desirable water conservation programme include?"
2. Arrange a panel discussion in which is reviewed "Our waters merit conservation for their recreational values".
3. Have one group of students prepare articles on the contribution of our waters to human welfare in the past. Have another group prepare articles on the contribution of the waters to the present.
4. Have pupils arrange a bulletin board upon which the following is shown:
    a. Damaged and neglected water values.
    b. Water values protected and efficiently used.
5. Arrange a panel discussion in which each of the following is represented:
    a. The farmer. b. The engineer.
    c. The legislator.
    d. The teacher.
6. Have each representative indicate what he can do to improve water conservation.

V. Evaluation Suggestions

A. Have each pupil evaluate himself on the following:
1. Have I gained added interest in conservation?
2. Have I worked effectively—
    a. Independently?
    b. With a number of groups?
3. Have I learned to use books more effectively?
4. Did I accept criticism willingly?
5. Have I applied some of the things I learned?

B. Have each pupil list concepts relative to water conservation which merit retention.

C. Have pupils list things each plans to do in the future which are in keeping with values learned.

D. What was the quality and extent of work on:
1. The scrap book. 2. The anecdotal record.

Mineral Conservation

I. Significance of the Topic

A. BASIS OF OUR PRESENT CIVILIZATION

Our present civilization is absolutely dependent upon the availability and utilization of mineral resources. The bewildering variety of uses not only of metals, but also of fuels such as coal, oils, and natural gas and of many other minerals for so many purposes in our complex civilization make us dependent upon the exploitation of the mineral resources of the world. Exhaustion of even a few of these resources would force major changes in our way of life.

B. NON-RENEWABLE RESOURCES

The alarming rate at which our mineral resources are becoming exhausted is rapidly making people aware that some may be completely depleted within our lifetime. Unlike forests which can be regrown, or soils which can produce crops generation after generation if kept in good condition, the supply of minerals in the ground is limited. Once the minerals are taken from the ground the supply is gone. There is no means of renewing mineral resources.

C. MINERALS CAN BE CONSERVED

Whenever possible, non-critical minerals should be substituted for critical minerals. For example, lead used in paints cannot be recovered and reused, but the less critically available titanium can be substituted and the lead used for other more necessary purposes. More careful practices to save scrap metals and to reuse the above ground supplies will also make it less necessary to mine more new ores. Less wasteful methods of mining and of uses of minerals will also make our supplies last longer.

D. EXHAUSTION OF MINERAL RESOURCES

As the readily available supplies of any mineral become exhausted, the greater difficulty of mining or otherwise obtaining the resource will cause the cost to rise. Eventually the supplies will become completely exhausted and future generations (not in the distant future) will have to seek substitutes if they can be found. If no such substitutes can be devised there must be major changes in the type of civilization enjoyed by man, if he is to live as he has lived.

E. NECESSITY OF INTELLIGENT CONSERVATION

The problem in mineral conservation is to so direct the utilization of mineral resources that their exploitation and exhaustion does not impede the progress of man.

II. Outline of Content

A. SIGNIFICANCE TO OUR WAY OF LIFE

1. Actual mineral reserves in the province
2. Our demands as compared to our limited supply
3. Identification of local minerals and other common types
4. Nations which have a varied mineral supply may have better commercial possibilities for international trade

B. KINDS AND CHARACTERISTICS

1. Those found in the province
2. Those found in other areas and consumed in the province
    a. Mineral fuels
    b. Metallic minerals
    c. Non-metallic minerals

C. THE FORMATION OF MINERALS

1. Those found in the province
2. Those found in other areas and consumed in the province
    a. Mineral fuels
    b. Metallic minerals
    c. Non-metallic minerals

D. LESSONS FOR THE FUTURE

1. Past attitude toward minerals and the results
2. Our country's present mineral problems —remedial measures

E. TRENDS TOWARD MINERAL VALUES

1. Sociological
    a. Possibilities of new discoveries
    b. Possibility of free movement among nations
    c. Private versus public ownership
    d. The use of water power and electricity versus use of exhaustible fuel resources
    e. The use of oil and gas lines versus the use of exhaustible fuel resources

F. MODERN SCIENTIFIC RESEARCH

1. Treatment of minerals for preservation
2. Manufacture of nylons, rayon and other plastics
3. The use of substitutes for minerals
    a. Soybeans and peanut products
4. The use of by-products
5. The use of atomic energy as a means of conserving exhaustible fuels, etc.

III. Possible Outcomes

A. KNOWLEDGE AND UNDERSTANDINGS

1. Knowledge as to the kinds, the location and the extent of mineral resources in our province, in our nation, and in the larger deposits of the world
2. Knowledge as to the variety of ways in which man puts this resource to his use
3. Knowledge of the dependence of human welfare upon mineral resources in this age of power and machinery—conservation is necessary to continued prosperity
4. Knowledge of the distribution of mineral resources, and of the nearness of certain kinds of manufacturing to certain centres of resource supply

B. APPRECIATIONS AND ATTITUDES

1. A desirable attitude toward the care and desirable use of the things we utilize in our everyday life to the end that contributing exhaustible resources will be available for a larger number over a longer period of time
2. Appreciation that wise distribution is a significant factor in the maintenance of a more permanent peace

3. An appreciation that the government has a custodial responsibility in reference to mineral conservation
4. Such attitudes (toward and interest in current literature about minerals) which will stimulate the student to continue reading in the mineral area whether for enjoyment or as a means of solving problems in connection with mineral values

IV. Inventory of Possible Activities

A. INITIATORY ACTIVITIES

1. Figure how much it costs to heat your home. What kind of fuel is used? What economics might be started which would conserve some of the fuel you are now using?
2. Make a survey of the kinds and amounts of fuel used in your community, and indicate the locality from which each was obtained.
3. Survey your library, and list books and articles on minerals, their sources and use.
4. Visit a coal dealer, and obtain samples of the different kinds of coal he supplies, and the source and cost of each kind.
5. Visit a gravel pit, quarry or iron mine, and write an account of the evidences of waste.
6. Visit the local filling station, obtain the name of the company from which it receives its oil products, and have one class representative write the company for literature on the source, the refining and the distribution of oil.
7. Explore the school, and list the kinds of minerals used in the building.
8. Make a collection of the different kinds of rocks and minerals found near your school.
9. Bring to class samples of as many kinds of metals as you can for later identification.
10. Prepare or obtain outline maps of your province upon which to locate mineral resources available.
11. Have a student write the Department of Mines at Ottawa, for a list of publications. Send for some of these for class use.
12. Visit your cement dealer, and obtain, if possible, literature on the manufacture and distribution of cement.
13. Visit your local fertilizer dealer, and obtain samples of fertilizers on sale and literature on the ingredients of each kind and the source from which it came.
14. From the pictures of coal mining, draw a cross section of a coal mine, and explain how it is mined.

B. ACTIVITIES AND DISCUSSIONS

1. It is estimated that 250 million tons of coal is wasted annually through incomplete combustion. What is this worth at the price you pay per ton for coal in your community?
2. It takes 1.6 tons of coal to make a ton of coke by the beehive method. The retort method, however, is about 10% more efficient. If 200,000 tons of coal were converted into coke, how much coke would be obtained by each process? How much more by the one than by the other?
3. Survey your locality to obtain information on location and extent of mineral resources. How long will these resources last?
4. On a map of the world locate the various minerals which are used in your everyday life.
5. Draw a map of Canada and indicate the sources of coal.
6. Obtain as many kinds of minerals as you can and place them in the three major groups—mineral fuel, metallic and non-metallic; identify each.
7. Plan field trips to a mine or quarry.
8. Group minerals under three major groups:
    a. Mineral fuels
    b. Metallic resources
    c. Non-metallic resources
    (Mineral fuels include coal, peat, petroleum, and natural gas. Metallic resources include iron, copper, lead, zinc, gold, silver. They also include such subordinate metals as manganese, chromium, mercury, vanadium, and tungsten. Non-metallic resources include sand, gravel, slate, clay, arsenic, borax, gypsum, salt, sulphur, asbestos and asphalt.)
9. Plan a scrap metal drive. Collect old metals and sell them. Compare prices for old metal with prices for new metals.
10. Prepare presentations which will explain the formation of minerals found in Canada and so far as possible, those found in other parts of the world.

11. Obtain and explain evidences of man's misuse of various minerals during Canada's early history.
12. Obtain evidences to show the rapidity with which minerals are consumed during war periods.
13. Make a list of substitutes and list the minerals they replace.
14. On a map of the province locate:
    a. Water power plants which are serving as a means of conserving fuel resources.
    b. Places where water power plants may be located to advantage.
15. Interview a qualified person who is interested in the promotion of oil and gas lines to obtain information as to the advantages of oil and gas over our fuel resources.
16. Prove that minerals played an important part in the early history and settlement of our country.

C. CULTIMATING ACTIVITIES

1. Have each member of the class give the implications of a major concept included for minerals in this area and justify it.
2. Present a panel programme in which you show how minerals contribute to life in your community:
    a. Food
    b. Shelter
    c. Clothing
    d. Labour
3. Suggest ways of improving our attitudes toward the conservation of minerals.
4. Have a member of the class present the significant elements of each following phase:
    a. Significance of minerals to our way of life.
    b. Kinds and characteristics of minerals.
    c. Formation of minerals.
    d. Man's past misuse of minerals.
    e. Trends of thought toward mineral values.
    f. Some interesting result of scientific research.
5. Use for culminating discussion such problems as follows:
    a. Positive and negative aspects of atomic energy.
    b. The devastating effect of war upon our mineral resources.

V. Evaluation Suggestions

A. Have the students draw up a list of generalizations or conclusions which grew out of their study of minerals. Compare with concepts stated.

B. At the beginning of the unit have pupils list the questions which they would like to have answered concerning minerals. At the conclusion of the unit have the pupils answer briefly but effectively the questions proposed.

C. Develop a factual test with your group covering the learning values included in this unit.

D. On the basis of student studies have them plan a programme of mineral conservation for their locality.

E. Following effort under "D" have students write editorials enlisting community support of this programme.

Forest Conservation

I. Significance of the Topic

A. FORESTS HAVE CONTRIBUTED MUCH

The original forests have contributed an important era in our history. From small beginnings the lumber industry grew and expanded. As the timber was stripped from the land and the soil broken to the plow, the lumber industry provided employment for many men. The period in which the timber was removed is one of the most interesting chapters of pioneer history.

B. OUR ECONOMIC FUTURE DEPENDS GREATLY UPON ITS FORESTS

It is only through careful forest management of our remaining forest resources that we can hope to continue to employ industrial wage earners in wood-using industries. If we are to continue to go forward industrially, the full use of forest lands which can supply the raw material for these industries must be encouraged. Our failure to recognize this will not only prove harmful

to the wood producing sections of the country, but for the residents as a whole and for future prosperity. Much land suited only for forest purposes but now unproductive should be restored to forest productivity.

C. PUBLIC INTEREST IS VITAL

Much of our industrial future may be dependent upon the attitude of the public toward the proper use of forests. Box factories, sash and door factories, wooden ware factories and planing mills are using millions of board feet annually. To this must be added the timber needs of furniture, paper and pulp excelsior and other wood-using industries, as well as the large amount of lumber used in building trades. A considerable amount of our prosperity may depend upon citizen understanding of the importance and of the wise management of our forests.

D. SOUND MANAGEMENT ESSENTIAL

Since much of the merchantable timber of this country has been removed, we face the problem of managing and restoring our forest lands. We have used and are still using wood fibre faster than we produce it. The paper industry is one of the chief present day consumers. Definitely, sound management of second growth stands of timber will determine the economic well-being of the paper and other industries fifteen to twenty years hence and of the future. In order that industry may have its raw materials readily available, our forests must be put under management and protected from fires, insects, and disease. The development of cooperatives sustained yield, and improved methods of harvesting are necessary. Without the products, uses and services of the forest it will be more difficult for the people to maintain their present standard of living under our present technical knowledge.

E. FORESTS CONTRIBUTE DIRECTLY TO HUMAN VALUES

In addition to trees which are harvested as a crop for industrial purposes, our forests must also be managed in such a way that our people may be able to continue to enjoy them for their beauty and the recreational opportunities they provide. While economic forest benefits are of primary concern, the security and satisfactions of individuals, families and communities are equally important. Intelligent forest management enhances security through full time vocational occupation, while the aesthetic contributions of animals, birds, flowers and trees contribute much to stability in human life. A well adjusted personality is a highly desirable attribute of each person in our complex industrial life. Forest recreation and appreciation contribute to these values.

History shows it to be an important fact that nations which have had adequate acreages of productive forests have prospered. We can assume that the forests of this nation will be an important factor in our social and economic progress in the future.

F. OTHER CONTRIBUTIONS

Many other areas of conservation are dependent on forests. They help anchor the soil, conserve the supply of water, act as havens for wildlife and contribute markedly to recreational aesthetic values.

II. Outline of Content

A. FOREST RESOURCES

1. Actual forest reserve
2. Supply in comparison with demand
3. Identification of common tree species

B USES OF OUR FORESTS AND TREES

1. Products
2. Watershed protection
3. Wildlife habitat
4. Recreation
5. Windbreaks and Shelter Belts

C. PRESENT PROBLEMS AND PRACTICES

1. Wasteful lumbering
2. Uncontrolled fires
3. False conceptions of land use
    - a. All wooded lands would become suitable for cultivation
    - b. All woodlands were suitable for pasture purposes
    - c. Forest ownership involves no responsibility to the public
4. Exploitation
5. The belief that forests are inexhaustible

D. FOREST CONSIDERATIONS FOR THE PRESENT AND FUTURE

1. Modern forest management policies and practices
2. Enemies of the forest, and modern methods of control
    - a. Diseases
    - b. Insects
3. Forests in relation to land use
4. The forest crop law
5. Modern zoning
6. The farm woodlot, its care, management and use
7. Private versus public ownership
8. School and community forests
9. Trees for ground beautification

III. Possible Outcomes

A. KNOWLEDGE AND UNDERSTANDINGS

1. Knowledge of the variety and extent of forest resources—local, provincial and national, and of their commercial and noncommercial value.
2. Understanding of the relationships which exist between forests and other resources such as water, soil, wildlife, etc.
3. Understanding as to the implications of "wise use" in reference to forests, and results which follow the abuse of this natural wealth.
4. Recognition of the wide variety of materials which come from our forests, and something as to the productive process involved in the production of paper and other wood products.
5. Recognition of the significance of a local forest conservation programme and of the availability and kinds of assistance which may be had from various local, provincial and national forest agencies to carry out such a programme.

B. ATTITUDES AND APPRECIATIONS

1. An appreciation of the contribution which forests and trees make to man's cultural, recreational and aesthetic life.
2. Permanent reading interests in current forest conservation content, and ability to weigh and evaluate conservation values.
3. The will to engage actively in some phase or phases of forest conservation activity.
4. An appreciation of natural forest beauty, and a recognition of the contributions which poets and artists have made in the interpretation of such beauty.
5. A recognition that personal control from within as well as legislative enactment and obedience to law are essential to the best forest conservation interest.

IV. Inventory of Possible Activities

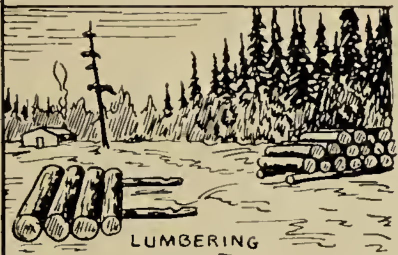
A INITIATORY ACTIVITIES

1. Explore the community to determine the kinds and the extent of the trees commonly found.

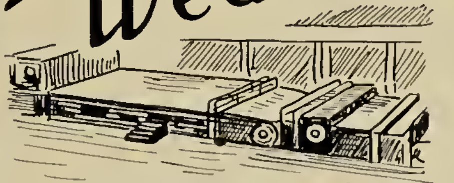
Our FOREST Wealth

THE HEALTHY FOREST HAS A GOOD BALANCE OF LARGE AND SMALL TREES, AND AN ABUNDANCE OF PLANTS AND ANIMALS

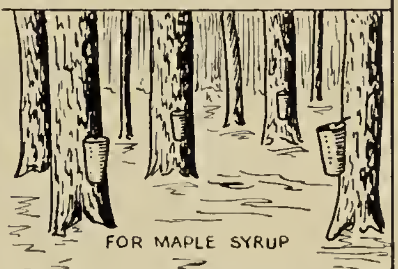
TAKE A TRIP TO A WOODS. HOW MANY LIVING CREATURES CAN YOU SEE THAT DEPEND ON THE FOREST FOR THEIR WAY OF LIFE?



LUMBERING

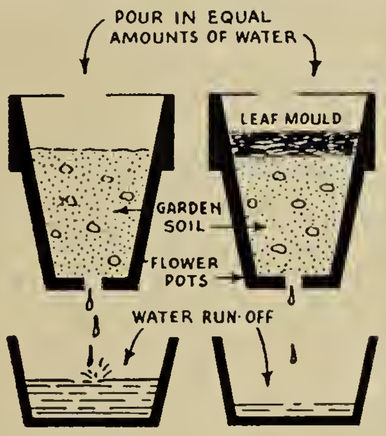


PAPER-MAKING



FOR MAPLE SYRUP

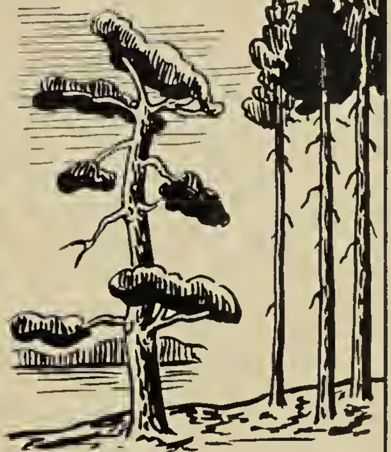
HERE IS A GOOD TOPIC FOR A MURAL: "HOW MAN USES THE FOREST." ADD TO THE DRAWINGS SUGGESTED



FORESTS HELP TO PREVENT FLOODS, AND TO MAINTAIN A MORE EVEN FLOW OF WATER IN RIVERS. THIS EXPERIMENT SHOWS THAT THE LEAF-MOULD UNDER TREES SLOWS DOWN THE RUN-OFF OF WATER.

TREES HELP HOLD THE SOIL IN PLACE DURING HEAVY RAINS.

FOR LUMBER, FORESTS ARE NECESSARY:



TREE IN OPEN: MANY BRANCHES AND KNOTS; TRUNK UNEVEN

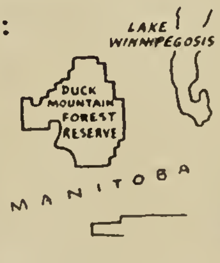
TREE IN FOREST: LOWER BRANCHES DIE OFF DUE TO SHADE OF OTHER TREES; TRUNK TALL AND STRAIGHT

SOME WAYS OF PROTECTING OUR FOREST WEALTH:

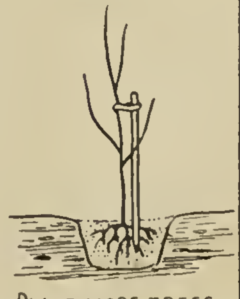
SELECTIVE LUMBERING

CARE WITH FIRE. ASK THE MAN WHO LIVES IN A WOODED AREA.

KEEP CATTLE OUT OF WOOD-LOTS SO THAT YOUNG TREES CAN GROW.



RESPECT OUR FOREST RESERVES.



PLANT MORE TREES.

D. FARWELL

2. Indicate on a map sketched of the local area where the various species of local trees are found.
3. Find out what industries of the community are dependent upon trees and what specific products are produced.
4. Interview old settlers to find out what changes have occurred in the population and industries of the region during the last fifty year period.
5. Survey the library for interesting articles and resource books on forests and forestry.
6. Interview a forest ranger to find out the responsibilities and work of such an official.
7. Visit a tree nursery and obtain information on seed planting, and also on the care and propagation of seedlings.
8. Take a trip to a farm woodlot which is pastured, and one which has been kept free from grazing. Note the comparative conditions for growth:
   a. The forest floor.
   b. The growing trees.
9. Visit a recently burnt over area to note the destruction by fire. Note the effect of fire on tree destruction, on the forest floor, and on the susceptibility of the area for erosion. Also, check for hidden damage from fire in a lumbering operation on an area burned in the past.
10. Collect pictures of trees, of forests, of conservation activities and of articles on forestry for a scrapbook. Maintain this scrapbook for current pictures and articles.
11. Sketch a map of the school grounds, and indicate upon it landscaping possibilities. This project should involve the selection and placement of trees, shrubs, and the location of parking area, driveway, and well-placed play areas.
12. Visit a local, provincial or national park to observe the care, management and use of such a park. Make recommendations for its improvement.
13. Gather information on school forests, and if possible visit one to observe its use for laboratory work.
14. Scan the tables of content of books, magazines and articles on forestry to note the various phases of forestry emphasized.
15. Cooperate with class members in writing forest agencies for available materials. Do not have more than one person send to the same agency for desired materials.

B. ACTIVITIES AND DISCUSSIONS

1. Developmental Activities
   a. Explain the contribution which forests make to life and living at the present time.
   b. How did the forests aid in the early settlement and development of Canada?
   c. Prepare a map of the province showing the present distribution of forests. Indicate the provincial forests and parks on this map.
   d. List some of the major industries which are dependent upon forests, and indicate the contribution of such industries to mankind.
   e. Make a list of recreational activities which people may enjoy in the forest.
   f. How does the forest indirectly benefit and protect the soil, streams, lakes and our wildlife?
   g. Describe tree growth, and indicate the importance of the bud and cambium layer.
   h. What natural factors contribute to tree growth?
   i. What is man doing by way of using the total tree?
   j. Give a review of man's exploitation policies of the early and later past.
   k. Give an account of the present paper industry, and explain the steps in the production of paper. A field trip should be taken to a paper mill if this can be done.
   l. Demonstrate how to build a camp fire, and indicate how it may be extinguished to safeguard life and property.
   m. Collect a cross section of a tree trunk damaged by fire. Note the scar, and damage caused.
   n. Check on natural reproduction of trees in a farm woodlot or school forest. What kinds of trees are reproducing themselves, and how will the forest change as maturity is reached?
   o. Start a school grounds or a school forest planting programme which is in keeping with preliminary plans made.
   p. Visit such forestry interest centres as the following and describe operations and services of each: (1) Forest Products Laboratory, (2) A saw mill,

(3) A pulp mill, (4) A tanning factory, (5) A veneer or plywood factory, (6) Some other wood using industry—chair or other furniture factory, etc.

q. Make an exhibit of the effects of tree diseases and use specimens and pictures to show the effects of damping off of nursery stock, white pine or jack pine blister rust, and the decay caused by typical fungi.

r. Make an exhibit of insect enemies of the forest, and include in this exhibit evidences of the insect damage done.

s. Prepare and exhibit samples of various kinds of wood finish and treatment.

t. Obtain information on the use of Christmas trees and greens in your community, and give the forestry implications.

2. Discussion Questions

a. How do the forest possessions of your community and province compare with those of earlier times?

b. How did the forest help and hinder the early settlement of the provinces and nation?

c. Indicate the extent to which people are dependent upon forests for:
  a. Occupational pursuits
  b. Recreational expression
  c. Consumer goods

d. How do the forests indirectly benefit and protect soil, streams, lakes and wildlife? What contributions do our forests make to our food supply (various kinds of nuts, maple syrup, pastured stock, wild game)?

e. Explain how man, trees and other plants, and animals are interdependent. Will industry become more or less dependent upon forests as time marches on?

f. What are the causes of forest fires, and what are man's responsibilities in reference to them?

g. Discuss "Glimpses into the life of a forest ranger."

h. What can we learn from the early exploitation of forests that will enable us to guard against the recorded abuses? Forest industries sometimes claim they cannot afford to practice conservation. To what extent are they right?

i. What governmental agencies are concerned about the conservation of forests? Explain the activities of each. Find out what precautions are taken to prevent importing forest insects and forest diseases from other countries.

j. Conservation is a required school offering. Is this legislative action justifiable?

k. What improvement can you suggest which might be made in cutting and milling practices?

l. Describe the process of paper making, and indicate the importance of this industry.

m. To what new uses have wood pulp and paper been recently put?

n. How do shelter belts contribute to life and living in certain areas of this province. Indicate where they are of most use in the desired protection.

o. Why is selective cutting so essential to efficient management?
  (1) Discuss the difference in the treatment of a forest as a crop, and its treatment as a mine.
  (2) Distinguish beween the meanings of devastation and exploitation.
  (3) Indicate ways in which harm is sometimes done to the vegetation in parks. How can these harmful acts be eliminated?
  (4) Why are large tracts of land which originally contained valuable timber allowed to revert back to the government? Explain.

p. Why is the woodlot so strongly advocated for farm units, and what consideration and care should be given them for maximum benefit? Why is cutting with a high stump still practiced when the lowest log (first 16 ft.) is the most valuable?

q. Justify, if possible, the statement that forests contribute their greatest service in soil building and water regulation.

r. Scientists at Forest Products laboratories are engaged in the solution of the following projects: (1) Fireproofing wood, (2) Prevention of decay, (3) Prevention of shrinkage (4) Joining and gluing, (5) Veneering, (6) Pulping, (7) Uses to be made of cellulose.

s. Give what information you can on the need for this research, and results obtained.

t. Discuss the manufacture of cellophane and rayon—two of the newer uses of wood which scientists have made known.

u. Think about the various occupational possibilities of the field—choose one from it, and discuss it using the following outline:
  (1) Occupation chosen
  (2) Reasons for selection: (a) Need to society, (b) Possibility for individual growth, (c) Permanency of occupation, (d) Remuneration, (e) Opportunity for leadership.

v. Some people advocate the use of wood substitutes as a means of saving wood. Take a stand for or against this thesis, and try to justify it to your classmates.

C. CULMINATING ACTIVITIES

1. Arrange a panel in which you have two students representing each of the following:
   a. The past in forestry
   b. The present in forestry
   c. The future in forestry
2. Arrange a panel in which a representative of each of the following expresses his concern about forests:
   a. The farmer
   b. The manufacturer
   c. The resident living on the bank of a large river
   d. The fisherman
   e. A person engaged in river transportation
3. Arrange and stage a programme on "A Forest Conservation Programme for our Community."
4. Arrange a bulletin board upon which one of the following is shown:
   a. Our forests then and now
   b. Our forest losses. How can the forest losses be reduced?
   c. Our forests and what they mean to us.
5. Organize a Conservation Club.
6. Establish a school forest.

V. Evaluation Suggestions

A. Do pupils react more effectively in reference to conservation interests with:

1. More voluntary reading about local, provincial and national forest problems?
2. Increasing understanding of specific forest problems?
3. Willingness to initiate or to participate in the more formal and inclusive forest conservation pursuits?
4. Application of good forest conservation practices for the everyday problems of his life?

B. Is there evidence of understanding of the implications of the major forest concepts listed as outcomes?

C. Do pupils respond meaningfully to such problems as—Suppose you were given the direction and control of forest conservation in your community and province? Indicate some of the policies you would advance in your administrative work.

D. Do pupils give evidence of beneficial vocabulary growth by showing an understanding of such terms as: forest, coniferous, deciduous, altitude, timber, board foot, watershed, hardwood, softwood, erosion, pulpwood, wood pulp, resin, piling, veneer, naval stores, plastics, saw log, veneer log, cut-over land, cord wood, timber line, reforestation, exploitation.

E. Do pupils have a reasonable knowledge of the effect of the destruction of forests on:

1. Wood supply?
2. Floods?
3. Washouts?
4. Droughts?
5. Waterpower?
6. Wildlife?
7. Rural home water supply (wells on farms, etc.)?

F. Do pupils reflect continuous interest in the efforts and findings of research as they appear?

TIM—BER R R!

When a tree falls its wood may be headed for any one, or several of 4500 different uses. We make lumber, plywood, poles, posts, and shingles from trees. By conversion we get paper, rayon, chemicals, plastics, paints and varnishes. All our wood-using industries depend upon our forests for raw material. The forest industries provide jobs, pay taxes, create taxable wealth and help keep our country strong. It's good business to prevent forest fires and keep our country green.

Wildlife Conservation

I. Significance of the Topic

A. WILDLIFE IS IMPORTANT

One of the finest attractions of Canada is its wildlife resources. Few of our boys and girls fully realize the magnificent opportunities for recreation and study presented by the variety of wildlife. Much of the enjoyment which people find in the out-of-doors is contributed by the boundless experiences with nature. Modern civilization is bringing about a greater appreciation of the æsthetic values to be found in wildlife. The more worldly appeal of dollars and cents may be shown too in the value of the tourist trade brought to this country by the wildlife, as well as by the direct economic value of its wildlife products.

When our country was a wilderness its wildlife resources were the magnetic attraction which brought the white man to conquer this wilderness. The wealth of furs brought about the establishment of the trading posts of our early history just as the wealth of timber brought about the establishment of our towns along the rivers. To the pioneer, wildlife brought not only wealth from the fur trade but also food and clothing for himself and his family. One of the most intriguing parts of our history is the period in which Great Britain and France vied with each other for the supremacy of the fur trade.

The meagre reports of the early trappers and missionaries indicate that wildlife did not always exist in the teeming abundance which we associate with pioneer days. The virgin forests with their deep shade and cover supported far less wildlife than the cut over areas with their more accessible and varied food and cover.

B. THE BALANCE OF LIFE IS DELICATE AND MUCH DISTURBED BY MAN

Every form of life is a product of its environment. The adjustment of living organisms to their surroundings is a gradual process. Any sudden disturbance of the environment tends to upset this very delicate relationship of plants, animals, soils, water and climate, and before readjustment can be made, serious injury or even extermination of some of the species composing the balance may take place. Thus, for example, when man rapidly cuts off the timber of large forest areas, the deer rapidly increase with the increased amount of low browse during the summer. The deer's winter yarding habit of staying in limited areas of cedar bogs soon crowds the increased number of deer into ranges too small to support their number. Abnormal concentrations make them easier prey to predators such as timber wolves which first thrived on easy hunting. In overcrowded ranges the deer also soon become victims of the limiting factors of disease and starvation and decrease in number.

The composition of the forest floor changes greatly with the disappearance of the forest. The smaller plants which form the undergrowth providing the habitat for innumerable forms of wildlife succumb to unfavorable chemical and physical changes. The breaking of the cover and the disappearance of humus starts erosion; thus destroying in a few decades the balance achieved by nature in many thousand years.

When man drains marshes to improve land he destroys the feeding and breeding grounds of waterfowl and other wildlife. Similarly, when man destroys hedgerow and fence line shelters, he destroys wildlife which tends to control insect enemies.

C. RESEARCH NEEDED TO MANAGE WILDLIFE RESOURCES

Wherever civilization has made inroads on nature there has resulted a decreased total loss of wildlife resources valuable to society. Belated realization of that loss has resulted in a programme of wildlife research to gain scientific knowledge in order to maintain as much of the original wildlife as managed land suited to the purpose will support. The economic aspect is evident. The food, cover, recreation, and beauty which provided the pioneer with the vital needs of life have great importance to millions today.

The very intricate interdependence of plant and animal communities must be understood if useful species are to be preserved under the artificial conditions of civilization. The study of these relationships is called ecology. The right control of the environment to favour wildlife populations is called game management. Game or wildlife research is the activity of discovering ecological truths. The application of this knowledge should help to maintain a satisfactory population of game and other useful wildlife.

D. A STUDY OF WILDLIFE SHOULD BEGIN WITH LOCAL RESOURCES

In heavily settled or intensively cultivated areas it is not possible to study firsthand the ecology of large game, fur or other animals, but common species like rabbits, mice, squirrels, foxes, muskrat, and numerous species of birds may be studied in any part of the province. The direct approach to the study of wildlife ecology, which is the key to wildlife conservation, is by way of knowledge of the species present in the student's own locality and province. With such experience it is easier to extend the study to one of national scope including problems involving species peculiar to other provinces and regions.

E. EVERY CITIZEN CAN PLAY A PART

Every boy or girl, every man and woman, has a definite responsibility in the perpetuation of wildlife. This is one natural resource which belongs to all people no matter where it may be found. While governmental agencies are entrusted with the management of wildlife, the cooperation of every citizen is essential. One should study and know enough about our wildlife to have a sympathetic and discriminating attitude toward recommendations for its management. The duty of recommending and supporting sound conservation legislation is also the privilege of the citizen. The observance of good outdoors manners and of conservation regulations are other responsibilities of our citizens. By cooperating with private and community conservation projects and clubs, one can do much to perpetuate our rich and valuable wildlife heritage.

II. Outline of the Topic

A. SIGNIFICANCE OF OUR WILDLIFE

1. Wildlife values—past and present
   - a. Economics—(1) Food, (2) Clothing, (3) Shelter, (4) Employment.
   - b. Recreation—(1) Hunting, (2) Fishing.
   - c. Aesthetic—(1) Birds and animals which provide enjoyment because of their beauty of form or colour, pleasing song, interesting ways, etc.

B. WILDLIFE POPULATION

(Wildlife population includes all birds, animals, and fish not domesticated by man. The animal kingdom includes all living things that cannot be called plants.)

1. General classification of our wildlife species:
   - a. Birds: (1) Game birds (quail, grouse, etc.) (2) Raptores (hawks, owls, etc.) (3) Song birds (robin, cardinal, etc.)

(4) Upland and migratory game birds.

b. Mammals: (1) Upland game mammals (those which provide food and sport, i.e., rabbits, white tail deer, etc.) (2) Non-game mammals (those which are not hunted for food, sport, or fur, i.e., shrews, moles, bats, etc.) (3) Fur bearing mammals (those taken primarily for their fur, i.e., beaver, otter, skunk, etc.)

c. Fish: (1) Game fish (bass, pike, muskellunge, etc.) (2) Non-game species (a) Rough fish (carp, buffalo, etc.) (b) Commercial fish (herring, lake trout, etc.) (c) Others (sunfish, minnows, stickleback, etc.)

d. Amphibia: (1) Frogs and toads (2) Salamanders.

e. Reptiles: (1)Turtles (snapping turtle, painted turtle, etc.) (2) Snakes (poisonous and non-poisonous species) (3) Lizards.

f. Invertebrates: Examples: One-celled animals (protozoa), sponges, worms, snails, clams, crayfish, spiders, and insects.

C. NATURE'S BALANCE FACTORS

1. Reduction and change of natural habitat of wildlife
   Examples:
   a. Development of agricultural land for crop production
   b. Over-grazing
   c. Removal of native vegetation
   d. Drainage of swamp and marsh areas
   e. Pollution of waters
   f. Development of urban areas
   g. Fires
2. Abuses of wildlife resources
   a. Abusive commercialization
   Examples:
   Excessive hunting, trapping, and fishing for the market. (A traditional practice in early history to supply communities, lumbercamps, etc. before wildlife regulations had been enacted. Still being practiced by commercial violators in defiance of the laws on the statute books at the present time.)
   b. Abuses of existing wildlife regulations Examples: (1) Hunting and fishing out of season (2) Taking more game and fish than bag and possession limit allows (3) Illegal practices—i.e.—dynamiting fish, headlighting deer.
3. Need for better wildlife regulations and enforcement
   a. Enactment of practical laws difficult because: (1) Lack of adequate knowledge and research about wildlife (2) Public demand by pressure groups conflict with sound wildlife regulations
   b. Need for larger number of law enforcement personnel (conservation wardens)

D. THE RESPONSIBILITY OF SOUND GAME MANAGEMENT

1. Governmental Agencies
2. The Public
   a. Groups giving cooperative effort (1) Conservation Clubs (2) Service Organizations (3) Schools (4) Others
3. Individual Cooperation

III. Possible Outcomes

A. KNOWLEDGE AND UNDERSTANDINGS

1. Knowledge of the kinds, characteristics, extent, and value of wildlife in the locality, province and nation.
2. An understanding of the numerous ways in which wildlife contributes to the life and living of man.
3. An understanding as to how wildlife welfare is dependent upon "balance in nature."
4. A knowledge of wildlife conservation services, and how such services may be utilized in the development and successful operation of a wildlife programme of protection and restoration.
5. A knowledge of how each student may contribute to wildlife conservation.

B. ATTITUDES AND APPRECIATIONS

1. An appreciation of man's custodial responsibilities in reference to wildlife.
2. An abiding interest in wildlife literature and the skills necessary to interpret, evaluate, and organize data concerning wildlife.
3. A recognition of the place of law in a wildlife conservation programme, and a wholesome respect for such law.
4. The will to put forth continued effort in the direction of some phase of wildlife conservation effort.

IV. Inventory of Possible Activities

A INITIATORY ACTIVITIES

1. Explore the community to determine the

kinds and extent of wildlife found in the locality.

2. Interview an early settler of your community on the question, "How has the wildlife of our community changed during the last half century?"
3. Visit a taxidermist to view different species of wildlife preserved.
4. Build and operate a bird feeder to use in your study of bird life.
5. Talk to a local trapper to determine whether his trapping is for enjoyment or for economic purposes.
6. Visit a local fur ranch, pheasant rearing pens, or fish hatchery.
7. Invite your local game warden to talk to your class about his work in the field.
8. Invite a Forest Ranger from your fire protection district to talk about his work.
9. Show animal films.
10. Collect and mount pictures of wildlife found in your community.
11. Cooperate with the class and the teacher in writing agencies for available materials and literature. *Do not have more than one person send to the same agency for desired materials.*
12. Find materials in books and magazines which concern wildlife.
13. Learn to imitate the songs of several birds in your community.
14. Visit the home of the muskrat and the beaver, and observe the construction of a beaver dam.
15. Collect nests of birds and keep a record of where the nests were found.
16. Read a poem about birds and wildlife to your class.
17. Draw or sketch a bird or animal in its natural habitat.
18. Organize a nature or conservation club in your community or school, and outline a constructive programme of activities related to wildlife for the year.

B. ACTIVITIES AND DISCUSSIONS

1. Developmental Activities
   a. Prepare a map showing distribution of wildlife in your province.
   b. How did wildlife in Canada aid the early settler? After having studied wildlife conservation in detail, indicate how wildlife is of greater importance to man today.
   c. What major industries are dependent upon the wildlife harvest and how can this importance be shown?
   d. Develop a bulletin board on which you show how wildlife contributes to the life and living of man and how man may contribute to the life and living of wildlife.
   e. Name ten common migratory birds, and chart their routes on a map of the Western Hemisphere.
   f. Make a survey in which you show: (1) Kinds and numbers of wildlife animals, common to your locality (2) Characteristics common to these animals (3) Description of their habitat (4) Kinds of common food which they consume (5) Migratory habits if any (6) Value.
   g. Make plaster casts of tracks of birds and mammals, and identify each.
   h. Survey your community for the following: (1) Kinds of lakes and streams (2) Kinds of fish found in these lakes and streams (3) Conservation practices carried on (4) Improvement possibilities of the habitat of fish in these lakes and streams.
   i. Make a survey of the reptiles and amphibians in your locality to determine the following: (1) Habitat and habits (2) Food (3) Reproduction (4) Ways in which they help or harm man.
   j. What changes do we find in the wildlife now prevalent in our province as compared to that which was originally found here?
   k. What effect did the commercial game hunter have upon our wildlife?
   l. What contribution has science made in the development of insecticides and how may the wrong use of these insecticides affect the balance of life in nature?
   m. How has the bird population changed during the past fifty years? Account for this change.
   n. How can the habitat for bird life in your community be preserved and improved?
   o. Make a list of the common enemies of bird life.
   p. Why is it advisable to study living things in their natural habitat and when they are brought into the class-

room to retain them for a limited time only?

q. Design and construct bird houses, feeders, and shelters. Give reasons for characteristics of design and construction.
r. Make a chart of plants which supply food for birds.
s. What are the implications of the high and low prevalent cycles of wildlife observed in recent years?
t. What common enemies of wild animals do you have in your community?
u. How can the wildlife habitat in your community be preserved and improved?
v. Examine the contents of the stomach of freshly caught fish to determine the kinds of food they consume. List the different kinds of food and determine if you can where it comes from.
w. Survey some of the streams of your locality with particular attention to the temperature in relation to the kinds of fish caught. Report results to the class.
x. Obtain a copy of the Fish and Game Laws for your province. Study and discuss the reasons for the open and closed seasons, bag limits, and the reason why certain areas are closed or open to hunting and fishing.
y. Visit a local commercial fisherman. Find out about species of fish commonly caught, the making and keeping of nets, marketing of the fish, life of the fisherman, the difference in the fish catch now as compared to that of fifty years ago, also any other information related to wildlife.

2. Discussion Questions. (These questions parallel foregoing experiences)
   a. How does wildlife contribute to man's effort to obtain food, clothing, shelter and employment and recreation?
   b. Give the major divisions of wildlife population.
   c. What has the history of wildlife protection legislation been in your province? Why has legislation been necessary?
   d. Explain the characteristics of a true sportsman in reference to hunting, trapping and fishing.
   e. Discuss farmer-sportsman relationship and suggest how it can be improved.
   f. What international problems have arisen pertaining to migratory game birds?
   g. What is the purpose of bird banding and fish marking?
   h. Discuss the harvesting of game species. Why is it necessary at times to protect them and at other times to remove the surplus?
   i. Discuss relation of the planting of fish to the control of environment.
   j. In what ways are the local, provincial and national governments contributing to the preservation of wildlife? Should the services of one or more of these agencies be modified or extended? Explain how.
   k. Assume that you are elected to the legislature. Propose a game management improvement programme which would be helpful to your community.
   l. Assume that you are a warden charged with the responsibility of informing a group of hunters, trappers, fishermen, and tourists as to precautionary measures that are to be taken in reference to safety. What advice would you give them?
   m. Find studies which indicate that owls and hawks are not as harmful as many people assumed and give reasons for this change in attitude.
   n. How does damage done by wildlife affect human welfare in your community? And how can this damage be reduced?
   o. Discuss the divisions of and the functions and responsibilities of the provincial conservation organizations. Compare the functions of your conservation organization with those of other provinces.

C. CULMINATING ACTIVITIES

1. Have each member write a conservation code which he would be willing to use as a personal conservation conduct guide.
2. Write a set of safety rules for outdoor people (hunters, fishermen, trappers, vacationists).
3. Build a conservation trail in your community.
4. Explain the care and consideration a helpful and cooperative camper will give

to his camp and campsite during his stay in the woods.

5. Map out a good conservation programme for your conservation club.
6. Write and present a radio programme to your school on one of the following:
   a. The match is a dangerous instrument when carelessly used.
   b. How our school helped in the province-wide conservation programme.
   c. Nature moves toward the development of essential balance.
   d. Topics of your selection.
7. Write a newspaper article in which is publicized some noteworthy conservation effort.
8. Write an article for the newspaper in which recommendations are made for the need of conservation effort to improve a conservation problem in your community.
9. Hold a mock trial in which a person is tried for the violation of some of the rules of conservation.
10. Hold a panel discussion upon the topic, "What the conservation programme of our community should include."

V. Evaluation Suggestions

A. Have pupils developed a fair understanding of the meaning and application of various concepts included on wildlife.

B. Does the pupil recognize the social implications of conservation?

1. Does he cooperate with others in furthering practical wildlife conservation values?
2. Does he show growth in tolerance of others who may differ in their thinking with him in their wildlife conservation thinking?
3. Does he appreciate the contributon that wildlife conservation can make to life and living generally?

C. Does the pupil show that he has improved certain individual skills through the effort in this area?

1. Better ways of thinking, judging, and working
2. Improved expression
3. Can he organize and summarize the wildlife values in keeping with the scientific method?

D. Does he approach and solve wildlife problems in keeping with scientific method?

E. Has the pupil developed an abiding interest in the contributions which science is making to the development of worthwhile wildlife values?

Recreation, Scenic and Historic Resources

I. Significance of the Topic

A. RECREATIONAL VALUE

The way of living and working in our present-day society is vastly different from that which existed in the society in which our forefathers lived and worked. The eight-hour work day has replaced the twelve or fourteen hour work day. Better means of transportation and communication have further increased the number of leisure hours people have to enjoy each day. Educators and parents have long recognized the importance of recreation in the total development of youth. Business corporations and other organizations are encouraging their employees to engage in healthful recreation. Child labour laws have also increased the need for additional recreational facilities.

Nature has provided Canada with an abundance of many kinds of natural resources which are lending themselves to the recreational interest and desires of millions of people each year. Millions of dollars are spent annually by people who are willing to pay for the privilege of enjoying these resources.

B. RECREATIONAL FACILITIES

Although exact figures cannot be given, it is generally accepted that present recreational facilities are inadequate, especially in densely populated areas. Provisions for these facilities have not kept pace with the tremendous expansion of leisure and in the attitudes society has taken toward recreation. Many people who most need recreational facilities cannot afford those available or may lack access to those available because of distance or other factors.

(Top) Prince Albert National Park, Saskatchewan, (Bottom) Banff National Park, Alberta

C. CAREFUL PLANNING IS IMPORTANT

Recreation has taken on a new meaning for all people. Millions today turn to nature for their recreation whether it is found in man-made parks within cities or in the great out-of-doors. The forests, parks, streams, lakes, mountains, seashores, and places of historic and scenic value, provide a means of recreation upon which many people depend. Today, careful planning of the use and perpetuation of our natural, recreational and scenic resources is of prime importance. A burned-over mountainside or a polluted stream or lake has little to offer in the form of recreation which people might enjoy.

D. EFFECTIVE EDUCATION IS VITAL

The combination of values included in recreational, scenic, and historic sites are of everlasting use if they are properly treated. To maintain and preserve these in good condition is the responsibility of every citizen who uses them. The schools must meet the challenge of educating the youth to meet the problem of using these resources to their utmost and yet maintaining them unharmed.

II. Outline of Content

A. SIGNIFICANCE

B. TYPES AND AREAS OF RESOURCES

1. Recreational Values
    - a. Provincial parks
    - b. Provincial and federal forests
    - c. Roadside parks
    - d. County parks
    - e. Municipal parks
    - f. Public hunting grounds
    - g. Game refuges
    - h. Public bathing beaches
2. Scenic Values
    - a. Topographic features—moraines, hills, waterfalls, dunes, escarpments, river valleys, mounds, caves, beaches, lakes, and streams.
    - b. Forests and prairies
3. Historic Values
    - a. Historic landmarks
    - b. Historic buildings
    - c. Indian mounds, villages, and reservations
    - d. Monuments
    - e. Battlefields and old forts
    - f. Memorials
    - g. Trails

C. NEEDS AND PROBLEMS

1. To provide public facilities that will benefit and satisfy the people
2. To regulate commercial facilities in the light of community interest
3. Additional problems
    - a. The need for more recreational facilities
    - b. Location of recreational facilities in relation to density of population
    - c. Misuse and depletion of recreational resources which are now available
    - d. Private exploitation of these resources
    - e. Maintenance and control
    - f. Development of new facilities
    - g. Zoning and land use
    - h. Highway improvement and establishment of roadside parks
    - i. Stream and lake pollution

III. Possible Outcomes

A. KNOWLEDGE AND UNDERSTANDINGS

1. A knowledge of the location of local and wide area scenic, historic, and recreational resources, and the contribution which they make to human welfare.
2. Understanding that man's life can be greatly enriched through the intelligent use of scenic and historic resources.
3. Knowledge of how recreational, scenic and historic resources are damaged and destroyed and how they may be preserved for the present and for future use.
4. Understanding that our scenic, historic, and recreational values are dependent on the combination of any or all of our natural resources, and that only through such fortunate combination has the tourist truly become important in Canada's economic life.

B. ATTITUDES AND APPRECIATIONS

1. A recognition and appreciation of Canada's rich endowment of natural beauty, and the contribution which that beauty makes to human enjoyment.
2. An attitude of deep-seated responsibility toward our valuable resources coupled with a desire to utilize them constructively.
3. An appreciation that young people have a custodial responsibility which implies the conservation, development and further creation of scenic and historic values.
4. An attitude of consideration and courtesy toward public and private property.
5. An appreciation of reciprocity between your province and its neighbours toward

(Top) Bird Sanctuary, Bonaventure Island, Quebec. (Bottom) Fundy National Park, N.B.

sharing the natural wealth of beauty with which each province is endowed.

IV. Inventory of Possible Activities

A. INITIATORY ACTIVITIES

1. Take a field trip to some place of beauty in the neighbourhood, while there, point out and try to describe the elements which are particularly appealing.
2. Develop further a collection of pamphlets, pictures and poems which include beauty values meriting use in your classroom.
3. Visit a provincial park or wild life reservation.
4. Interview some of the older settlers of the community to find out how community beauty has been helped and hindered over a period of years.
5. Visit a modern tourist camp and question the manager as to characteristics and services which are particularly appealing to visitors.
6. Start a booklet, "My Field Book" and in it keep an accurate account of field trips. Prepare interesting covers in the art class, and descriptive and illustrative sketches for the clarification of values observed.
7. Write for folders on your provincial and national parks.
8. Have pupils make a survey of the locality for places under the following headings:
    - a. Scenic places of significance
    - b. Recreational places of significance
    - c. Historic places of significance

B. ACTIVITIES AND DISCUSSIONS

1. Developmental Activities
    - a. On maps of the county, province, and nation, have students locate the twenty-five most significant places under each of the following: (1) Scenic places, (2) Recreational places, (3) Historic places.
    - b. Arrange some discussion periods in which students justify the selections which they have made under the preceding project.
    - c. Have each student choose a spot or area which is most repelling from the standpoint of appearance, and indicate how he would improve it were he in charge of a planning division of government.
    - d. If possible, visit a museum. After a study of objects on display, choose five or six which you consider of most significance and justify such choice.
    - e. On a map of the province, locate the provincial and national forest areas and parks.
      (1) Justify national and provincial participation in forestry in parks.
    - f. Many schools are now obtaining school forest areas, and some have excellent school forests in various stages of development.
      (1) Justify such projects
      (2) Indicate how such projects may be used to advantage for educational purposes.
2. Discussion Questions
    - a. Locate and justify the establishment of provincial and national parks.
    - b. Explain how provincial and national parks serve for recreational purposes.
    - c. How may real estate dealers help to improve a community? How do they sometimes hinder wise development?
    - d. Explain how each of the following policies is out-of-keeping with wise use: (1) Burning over grass land, woodland, roadsides, and idle land each spring, (2) Dumping trash on roadsides and in ditches, (3) Using creeks and rivers for sewage disposal, (4) Allowing builders to build homes upon lots very small in area, (5) Leaving litter on parks and camp grounds, (6) Allowing posters and bill boards to be placed along roadsides, (7) Allowing accessible stream sides and lake fronts to be purchased and exploited by private interests, (8) Allowing telephone and light companies to ruin roadside trees.
    - e. Discuss purposes and policies of local, provincial, and regional planning.
    - f. Design a civic centre and a central park for your community, and discuss such plan and characteristics in class.
    - g. Discuss ten places of historic significance which are within reasonable distance of your home and community.
    - h. Discuss the following topic—"Man creates an ugly civilization in many ways."
    - i. Discuss characteristics that should be considered in home grounds beautification.
    - j. Explain how the condition and care of your school grounds might be improved.

C. CULMINATING ACTIVITIES

1. Assume your community or city has adopted the managerial form of government, and that you are about to employ a manager. Hold a hearing to interview candidates, and have three or four class members assume each is a candidate for the available office. Have each present his plan as to the beautification of the community, the provision of parks, and the provision of adequate recreation facilities.
2. Arrange a round table of three to six members, and discuss the topic "What We Can Do to Improve Our Community." Consider:
   a. Historic interest places—kind of consideration they should be given and why.
   b. Needed recreational facilities and why.
   c. Needed scenic improvement and why —(Don't forget roadside signs and ugly appearing ravines.)
3. Assume that five or six of your class members are a committee to make recommendations for a memorial for veterans of World War I and World War II. Discuss how $75,000.00 might best be spent for such purpose.
4. Assume that your class is a committee to put on a campaign for the improvement of your community. What might well be included in such campaign, and how might it be carried out.
5. Have floor talks.
   a. One to be presented to the village, town or city council indicating the status of scenic and recreational facilities, and indicating how such facilities should be expanded and improved.
   b. One to be presented to the conservation commission showing how provincial parks might be more adequately maintained.
   c. One giving the history of the community, and pointing out the spots of especial significance that should be marked.
6. Hold a round-table discussion and point out the twenty places which you feel are of greatest historical significance in your area. Locate these on a map, and give reasons for your selection.
7. Hold a round table discussion on the tourist trade in the province. Bring out two special phases: (a) The value of such trade. (b) What can be done to further stimulate it.
8. If members of the class have visited one or more of our national or provincial parks, have reports on such visits. Have members utilize pictures if possible for illustrative purposes.
9. Present the history of your village or city —include your school, and also something as to prominent personalities and their contribution.
10. Plan a debate, "Resolved that Education is more effective than legislation as a means of promoting action and care in relation to recreation, historic, and scenic values."

V. Evaluation Suggestions

Evaluation in reference to this and other divisions of conservation implies much more than mere testing at the conclusion of work on a unit. It includes an appraisal of both quantity and quality of pupil growth all along the way as the teaching and learning process proceeds. The following questions appear significant for evaluation:

A. Do pupils realize that a well balanced life includes a fair proportion of time devoted to recreational activities, and that wholesome recreational pursuits contribute to character, personality and physical well-being?

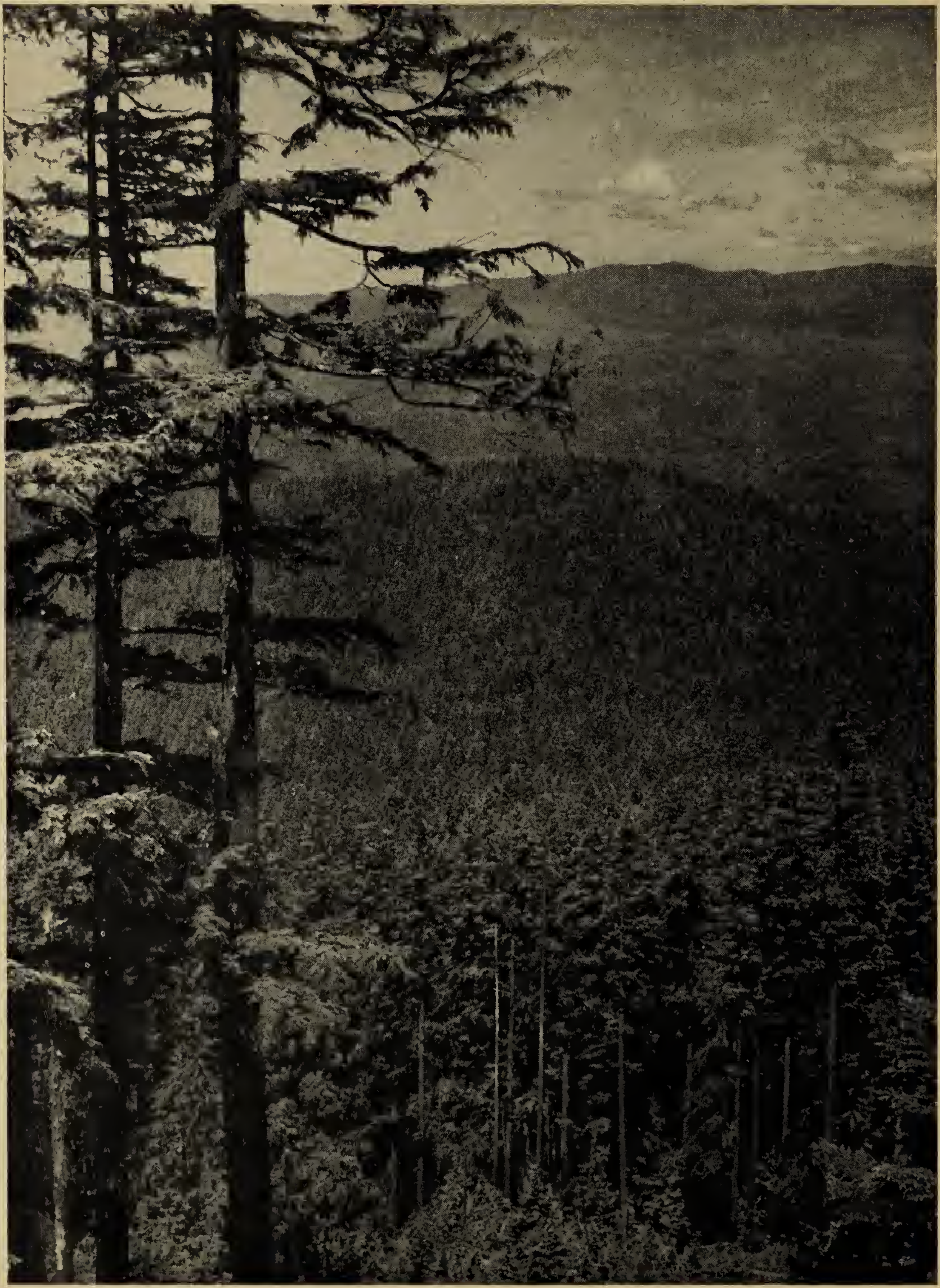
B. Do pupils recognize the significance of our historic places and persons? A recognition of person and place values comes through knowledge of the historical background of each.

C. Are pupils developing ability to recognize beauty in its many manifestations, and are they acquiring a wholesome desire to improve and enhance it wherever possible?

D. Are pupils coming to recognize the effectiveness of local, provincial, regional, and national planning as a major means through which to achieve conservation results?

E. Are pupils terminating their school's programme of conservation with a knowledge as to what they can do to preserve scenic values of their locality, and what they can do to enhance the beauty of their home and community?

F. Is there evidence that pupils carry on voluntarily in the matter of home, school and community beautification?



CONSERVATION IS THE ROAD TO ECONOMIC PROSPERITY

SECTION TWO

Conservation Resource Material

THIRTEEN CHAPTERS

THE word conservation has a thrifty meaning. To conserve is to save and protect, to leave what we ourselves enjoy in such good condition that others may also share the enjoyment. Conservation is the opposite of extravagance and wastefulness. It is an expression of good manners to nature and to our fellow men, including those of generations not yet born. It vitally concerns every man, woman and child.

Only a little more than three hundred years ago the whole North American continent was in a state which had been very little altered by man. It was a temperate-zone Garden of Eden, the last of the sort that existed on earth. In the forested parts trees not only covered the ground but they also grew to their greatest size and then continued to live until storms or lightning overthrew them, or until they died of old age. Other areas of the continent, where the average rainfall was somewhat less, were carpeted with long prairie grasses which served, like the forest and its undergrowth, to bind the soil and thus to prevent it from being washed away by rainfall and streams and so be lost in the sea. The running waters were kept under control by this cover of vegetation and by the spongy humus in the ground, so that drought and floods affected them much less than they do today, and clear, instead of muddy, water furnished a suitable home for huge numbers of trout and other fresh-water organisms of many kinds.

The extraordinary richness of the North American plant life in field, woodland and river valley was unequalled in any other temperate part of the world. And the abundance of animal life quite matched that of the vegetation. The accounts of all the earlier discoverers and travellers are filled with wonder at the richness of food resources in the ocean, the hordes of wild fowl, fur-bearers, deer, and many other kinds of beautiful and useful animals that flourished everywhere.

Our ancestors had no conception of how rapidly an expanding human population would outrun the supplies of raw material; most of them were obsessed, even until very recently, with the vague idea that the treasures were "limitless" and "inexhaustible". Most of the citizens of earlier generations knew little or nothing about the complicated and delicate interrelations that run all through nature, and which mean that, as in a living body, an unhealthy condition of one part will ultimately be harmful to all the others. Fifty years ago nature study was not part of the school work of children; scientific forestry was a new idea in our country; lumber was still cheap because it could be brought in any quantity from distant woodlands; erosion and river floods were not recognized as national problems; modern guns, smokeless powder and automobiles had not yet raised the odds against native game; nobody had yet studied long-term climatic cycles in relation to proper land use; even the word "conservation" had nothing of the meaning that it has for us today.

For the sake of ourselves and our descendants, we must now all set about repairing the mistakes of our ancestors. In view of the goodly heritage they have left us in most respects, the task will be a grateful one.

The broad significance of conservation should, therefore, be made part of the awareness of everyone in daily, workaday life. To understand the function of the water table in the ground is just as important in elementary education as a knowledge of the three R's. Children should learn why all watersheds need the protection of plant life and why the running currents of brooks and rivers must be made to yield their full benefit to the soil before they finally escape to the sea. They should be taught the duty of planting trees as well as of cutting them and should realize that the old-fashioned custom of stripping woodlands clean and then burning the slash, has now become an anti-social barbarism. They should learn the ecological importance of big, mature trees, because living space for most of man's fellow-inhabitants of our planet is to be computed not only in square measure of surface but also in cubic volume above the earth. As John Muir wrote, "There is no dearth like the hole in the sky when a great tree is gone." They must learn the relations between climate, soil, and correct use of the land, because the laws that bind these together cannot be broken with impunity. They must be made aware of the fundamental error behind most attempts to "control" animals supposedly objectionable to man. As a matter of fact, we cannot indiscriminately kill off even insects on a large scale without danger of doing more harm than good both to nature and ourselves. They must be informed that most of the land-drainage accomplished has led to results in which the damage has far outweighed the good. They must come to see that the more we can keep, the more we shall all have; that many wild flowers are best enjoyed where they grow instead of in vases; that game is a crop, of which we can harvest only the surplus; that nature is most rewarding when as many as possible of its elements are left in their primeval relation.

For untold millions of years, nature contrived to get along gloriously on this great North American continent without the dominating interference of man. It should be our ideal to restore as much of the primitive system as we find consistent with our own safety and with the new uses of land and sea required by a populous civilization. This task is not to be conceived as a hardship, because the conservation of all natural resources surely promotes the best conditions for man *himself*. — Robert Cushman Murphy.

Soil and Wise Land Use

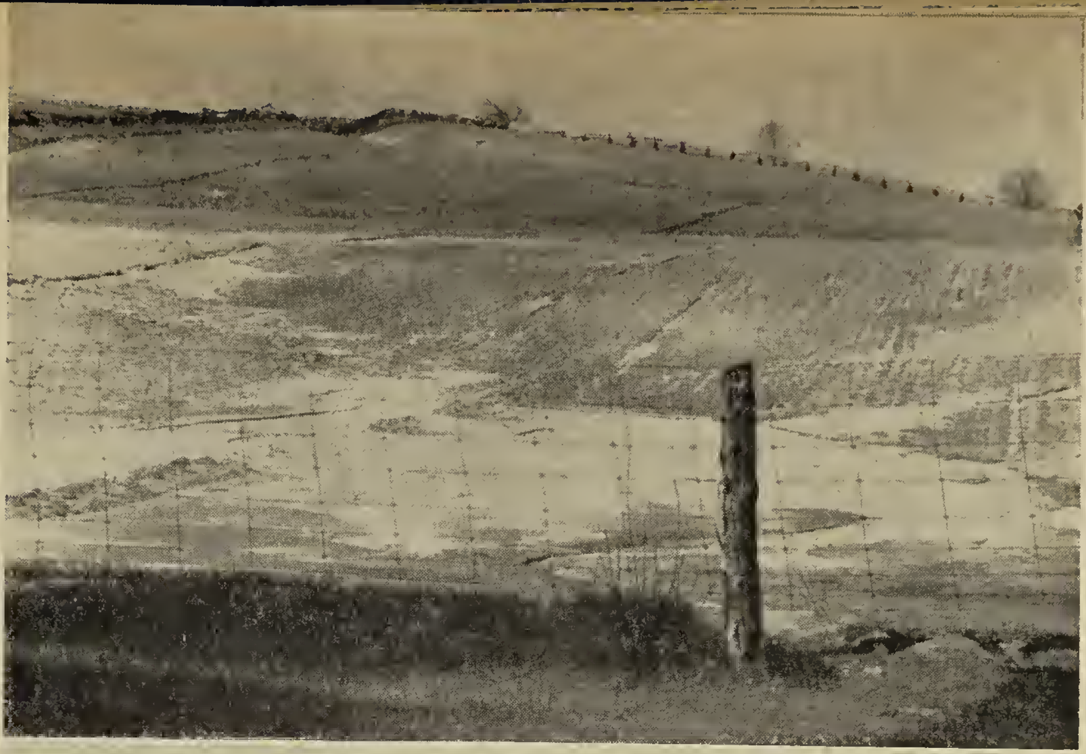
A. F. COVENTRY and J. R. DYMOND

ALL life depends on the soil. From raw materials taken from the earth and air, plants make proteins, carbohydrates and fats. Animals lack the power to make their own food from such raw materials, but must depend on food made by plants. If plants should disappear from the earth it would not be long before all animal life ceased too.

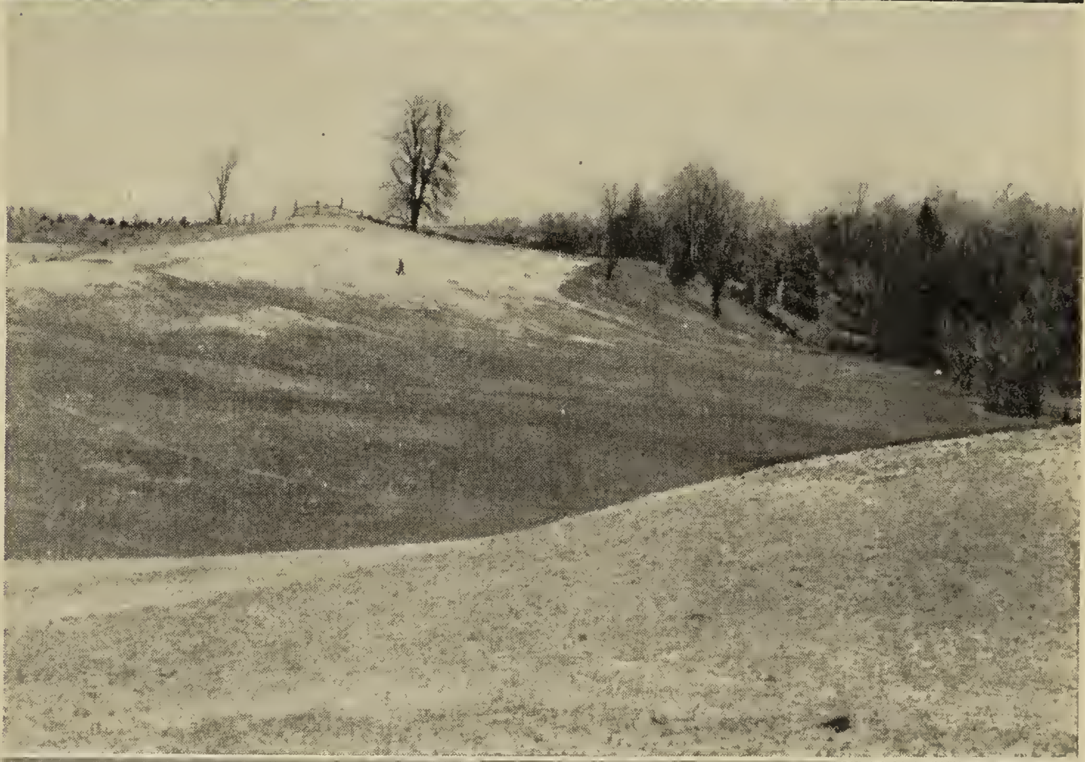
The same is true in water as on land. It is the nutrients washed from the land into the rivers, lakes and sea that support the plants, chiefly microscopic, on which all fish and other aquatic life depends. Except for such resources as oil, coal and minerals (which are also derived from the earth), all a country's wealth comes in the last analysis from the soil. Unlike oil, coal and minerals which once used up cannot be renewed, the living products of the soil—crops, fruit, livestock, forests, game, fur and fish—will, if the soil and its richness are preserved, reproduce continually.

THE ORIGIN OF SOILS

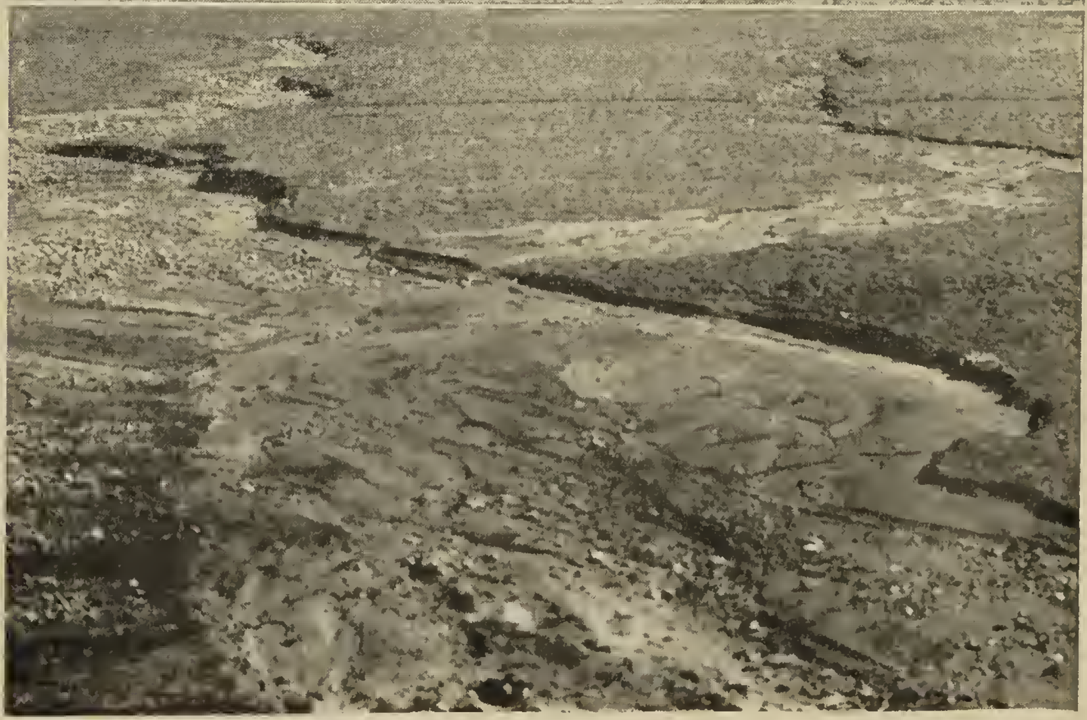
Soils owe their beginnings to the crumbling of rocks. The water-washed sand of the seashore or lakeshore is composed almost entirely of finely-ground rock. When a little sand has accumulated as a result of rock decay, lowly plants such as mosses can grow. When they die and their bodies decay, a little humus is added to the sand. With the continued decay of rock and the addition of more humus from the bodies of dead plants, there is finally formed enough soil to support larger and more advanced plants such as ferns and small shrubs. The larger bodies of these plants add humus still faster until finally there is enough soil to support trees. Year after year and century after century as plants shed their leaves and ultimately mature and



With no protective vegetation and furrows running up and down the slopes instead of across, the spring rains wash off valuable surface soil.



Steep hillside in background, from which the topsoil has been eroded away, exposing the subsoil. A spot for tree-planting.



Natural drainage courses such as these should be left in sod, otherwise erosion will occur.

die and their remains crumble through the action of insects, fungi and bacteria, humus accumulates until in places it reaches a depth of many inches or even feet. The remains of animals as well as plants contribute to the organic matter of the soil.

It must not be thought that soil is only a mass of dead material. It has been estimated that in some soils there live as many as 50,000 earthworms to the acre. Besides these and other worms, insects and similar sized animals, there are in most soils millions of tiny plants including bacteria, moulds and fungi, as well as myriads of microscopic animals. Through the action of plants and animals in the soil the materials of which it is composed are being constantly changed and redistributed. Earthworms bring up soil from lower depths to the surface. Burrowing animals do the same on a more conspicuous scale. Water seeping down from the surface dissolves certain nutrient materials and carries them to lower layers.

The Soil Profile

Most natural soils are made up of three layers—topsoil, subsoil, and a deeper layer of parent material. The surface layer of topsoil may vary in depth from a few inches to several feet. It contains most of the organic matter. When it is carried away through erosion the soil loses the greater part of its productivity. The middle, or subsoil layer, contains practically no organic matter. On some lands from which the topsoil has been lost, the subsoil is cultivated, but it yields very much poorer crops than the topsoil did. The parent material below the subsoil is made up of rocks and other material that is still little changed by soil-building processes.

The Composition of Soil

The nutrient materials found in the soil needed for plant and animal life include nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron and to a lesser extent chlorine, silicon, sodium, aluminum, manganese, boron, with traces of still others. Many of these are derived from the rocks whose decay has contributed to the formation of the soil.

Organic matter, derived from the decay of dead plant and animal matter, is important in several ways. It adds to such nutrients as nitrogen, phosphorus, potassium, and others. It promotes the activity of bacteria in the soil which is necessary to make certain nutrients available to plants. Organic matter also increases the water-holding capacity of soil, thus reducing the runoff and storing water for plant use in dry times.

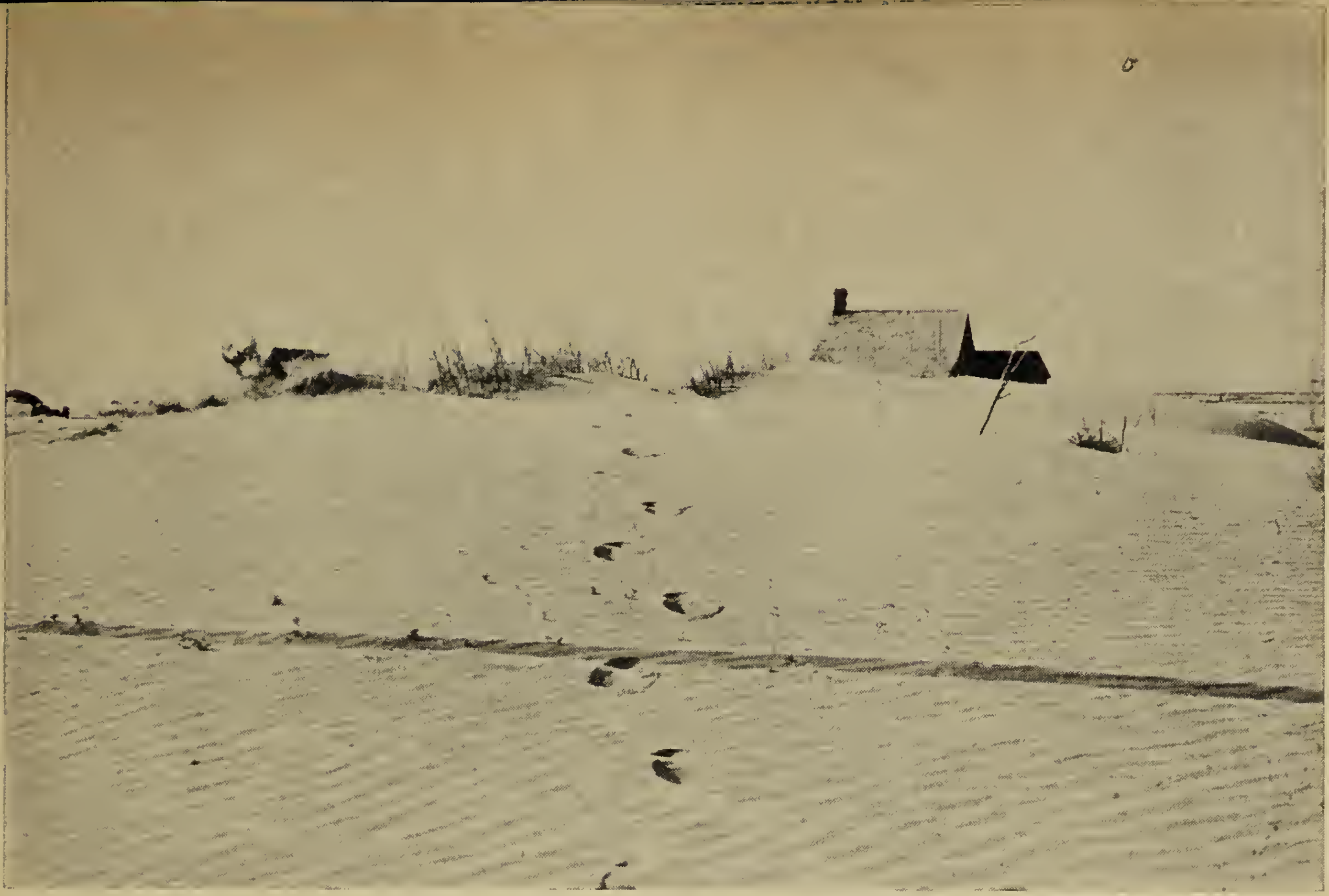
Soil Injury Through Erosion

Erosion, which means removing the top layer of the soil, is one of the ways in which soils are injured. *Water erosion* is the washing away of surface soil by running water. *Wind erosion* is the blowing away of surface soil by winds.

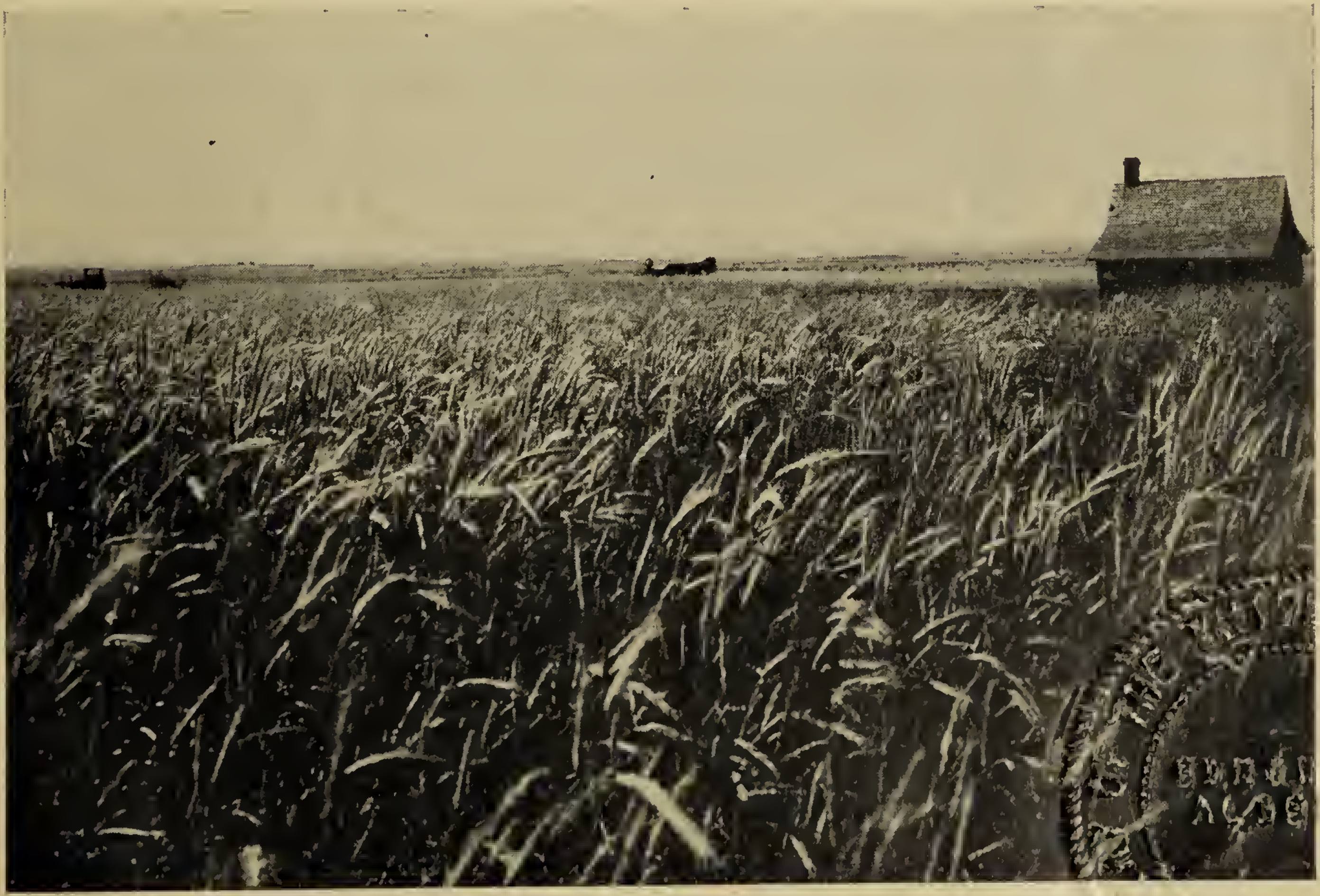
There are two kinds of water erosion, namely: *gully erosion* and *sheet erosion.* Gullies develop when water, running off sloping land, collects into little rills which gradually deepen as more and more of the surface runoff finds its way into the same depression. Sheet erosion is the gradual washing away of the whole surface of the land. Sheet erosion is far less spectacular than gully erosion, but it is more general and in the aggregate does and has done enormous damage to the agricultural lands of Canada. Sheet erosion, although more evident on lands with considerable slope, is often pronounced on gently sloping lands, especially where the land has been ploughed up and down the slope. From the air, this type of erosion is more obvious than from the ground, showing up as irregular, lighter patches on the darker background of the surrounding earth.

Extent of Erosion in Canada

Although serious erosion has occurred in many parts of Canada, the extent of injury to our lands is not accurately known since few surveys adequate to give us a true picture of its extent have been made. However, conservative estimates based on soil surveys in twenty-four counties in southern Ontario indicate that fifty per cent of the surveyed land is suffering from moderate to severe erosion. In some counties the proportion is seventy-five per cent. On some of the lighter soils in Ontario which once supported a magnificent stand of white pine, all of the topsoil and much of the subsoil have been washed and blown away, leaving expanses of barren sand. This sand is moved by every wind of sufficient force, sometimes covering neighbouring fertile lands whose topsoil is still largely in place. By these means many thousands of acres cleared at considerable labour by pioneers, to make what they hoped



WHEN THE GRASSES that had long held the soil of the plains were overgrazed or ploughed under, wind erosion took hold in many parts of the West. Plains once green with grass now look like deserts in many spots. Like sheet erosion, wind erosion usually covers a wide area. Sand is blown back and forth across the plains, settling into small hills called dunes or spreading out over what might otherwise be good farmland. (Above) In southern Saskatchewan. An extreme case of drifting in light soil, with no crops to bind the soil and prevent erosion by wind. (Below) The same area as above, several years later, with the soil held in place by a crop of rye. This land was brought back, but at a cost. What bitter disappointment, suffering and financial disaster could have been avoided by enlightened, intelligent use of the land!



would be fertile farms, have had to be abandoned. In some cases the land should never have been cleared because the soil was only suitable to grow forest trees; in others, wrong methods of handling the land have contributed to the destruction of the countryside.

In the prairie region of western Canada there are many areas, particularly in southern Saskatchewan and Alberta, where the cover of native grasses should never have been broken by the plough. During the drought period of the 1930's these areas, in common with similar areas to the south in the United States, suffered from wind erosion. In some places from two to twelve inches of topsoil were swept away, leaving only a poor subsoil. It has been estimated that it took nature from three hundred to one thousand years to produce only one inch of topsoil. This amount has on occasion been removed over hundreds of thousands of acres in two days by high winds following bad cultural methods.

OTHER CAUSES OF INJURY

Bad farming practices have caused serious losses to soil fertility in a number of areas. Cropping damages the soil in several ways. Such crops as corn and wheat remove a good deal of such plant foods as nitrogen, phosphorus, potassium and calcium from the soil. Unless these materials are restored to the soil, each time a crop is taken off less of these essential elements is left for subsequent crops. In some places from a third to a half of the original productivity of the soil has been reduced in this way. The continuous use of one crop on the same land removes more and more of the same soil materials. Ploughing and planting crops in rows up and down slopes favours the rapid runoff of water and increases erosion. Exposing bare soil surfaces to the eroding action of wind and water at seasons when these agents are likely to be most active, is another destructive practice.

SOIL DEPLETION AND HEALTH

The realization that the depletion of soil nutrients through erosion and unwise farming methods not only reduces productivity but may seriously affect the health of both animals and humans, still further emphasizes the vital necessity of conserving the mineral elements in the soil.

It has long been known that deficiency of iodine in certain soils leads to increased incidence of goitre. A lack of cobalt in the soil is detrimental to sheep and cattle. Deficiencies in phosphorus and calcium are indicated by cattle having a false appetite and the habit of gnawing at fence posts. There are many observations to indicate that livestock can distinguish between the pasture or hay grown on fertilized land and that grown on land deficient in certain nutrients. It has been stated that deficiencies in soil fertility are responsible for a large part of the heavy mortality among young pigs.

There is a steadily growing body of evidence to indicate that the loss of soil fertility is reflected in many deficiencies in the health of our people as well as in that of our livestock.

SOIL CONSERVATION PRACTICES

Farming practices which help to restore and conserve soil fertility include, first of all, avoiding the growing of crops on land unsuitable to them. When lands suitable only for hay, pasture or for woodlands are used for cultivated crops, erosion and soil depletion rapidly develop. A proper rotation of crops which secures a balance between soil-depleting and soil-restoring crops is the basis of good farming. Cover crops should be grown to protect the soil from wind and water erosion. Discing or ploughing these under adds humus to the soil, as does also the incorporation into the soil of crop residues such as cornstalks, straw, etc. Barnyard manure must be carefully stored and wisely used. Lime and other commercial fertilizers should be used when and as soil tests indicate their need. All of these practices are of course in use by all good farmers, but must become universal before our precious soil fertility is secure against unnecessary loss. The soil is not the property of one generation only. Once destroyed or badly damaged it will not yield the living to future generations which it is their right to expect.

WHAT FARM PLANNING MEANS

Besides the farming practices necessary for general soil conservation, special devices are required on sloping land from which running water carries away the surface soil. Slopes of more than six feet in a hundred should, if possible, be kept in meadow, permanent pasture or woods. The three chief methods of reducing erosion on sloping

A TYPICAL DUST STORM. Light, dry, unprotected soil has taken to the air, forming clouds of dust so dense that visibility at times is zero. Dust storms are caused by improper farming methods. They leave behind them dust bowls, desolation and abandoned farms.

BURNING REDUCES GRASS YIELDS in pastures, stimulates weed growth, increases water runoff, speeds up soil erosion and destroys the homes of countless valuable wild creatures—so why burn? Experiments in Wisconsin showed that burning blue grass pasture reduced the yield the following year 52% to 71%. Burning increased the water runoff 5 to 30 times and speeded soil erosion 4 to 11 times. The 3 or 4 inches of humus destroyed by burning contains an average of 50 lb. of nitrogen per acre. The nitrogen is released as gas, and thus is lost to the soil.

croplands are: *contour cultivation, strip cropping and terracing.*

In contour cultivation, ploughing, planting and cultivating are done on the level around the slope and not up and down it. Water running down slopes which are contour ploughed and cultivated is caught in level furrows or ridges and held and given a chance to sink into the soil. Contour farming is not as convenient as ploughing and planting in straight rows, but yields are usually higher. It is usually recommended to combine contour ploughing with strip cropping.

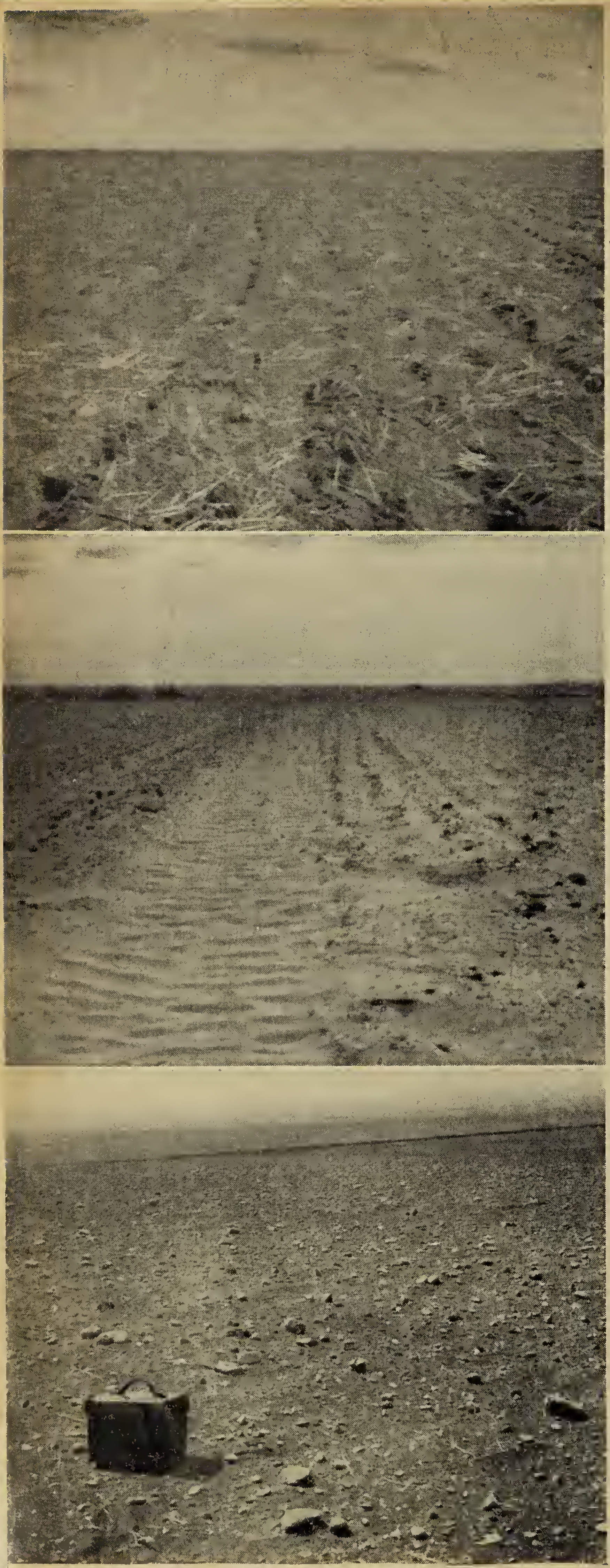
In strip cropping, strips of hay or grain are alternated with strips of cultivated crops such as corn, roots, etc., along contour lines. This practice is a further aid in the prevention of erosion and the conservation of water on sloping land.

Terracing consists in the making of ridges on the contours so that each ridge holds the runoff from the strip of land between it and the ridge above and compels the water to run along the furrow so formed, thus giving it a chance to sink into the soil. In areas of low rainfall terraces are used to catch and store water, while in regions of greater rainfall they cut down erosion.

The location of contours for contour farming and terracing should be done with the assistance of persons experienced in this type of work.

Gully Control

In gully control two objectives should be attempted—to get the bare eroding surfaces covered by vegetation, and to slow down the rate of flow of the water. When the speed of water is doubled, its soil-carrying capacity is increased 64 times. To slow down the rate at which water runs down a gully, check dams should be placed across it. Straw and brush held in place by fence-wire stretched across the gully will catch and hold much of the soil in small gullies. Planting trees,



(TOP) ALBERTA LAND properly farmed, providing a trash cover to hold the soil. (Centre) The spring following summer fallowing on ploughed land where no means of holding the soil has been effected. (Bottom) Most of the topsoil is gone from this field. Improper cultural practices are to blame for this condition.

sodding and other devices for getting the bare surfaces covered with vegetation are useful.

LAND CLASSIFICATION

When the problems of soil conservation are regarded from the social rather than from the individual point of view, a fundamental need is soil classification. Governments must, on the basis of proper surveys, decide which lands are best adapted for growing trees and which for agriculture. Agricultural lands must further be subdivided into those which are suitable only for hay or permanent pasture and those which may safely be devoted to tillage. Much of the soil deterioration of the past has been due to the attempt to farm land from which the forest or grass cover should never have been removed.

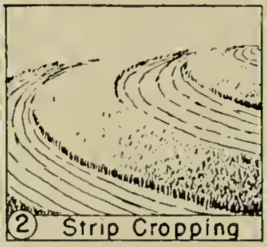
Some of the problems of saving the land and of restoring it to its proper use are too large for individual initiative; governments, whether municipal, provincial or federal, must acquire and reforest large blocks of land suitable only for growing trees. In the western provinces the federal government has, through the operation of the Prairie Farm Rehabilitation Act, regrassed extensive areas of marginal and submarginal lands. Until careful surveys have been made of all our lands, and governments as well as individual land users face their responsibilities of using the land wisely, the deterioration of the soil will continue.

NATIVE GRASSLANDS still constitute an important part of the agricultural resources of western Canada. At least 52 million acres in the three prairie provinces and in British Columbia are used as rangeland and farm pasture. Much of this is rough land, light sandy land, or land otherwise unsuited for cultivation. Many of the rangeland areas in the prairie provinces have, through the work of the Prairie Farm Rehabilitation Act, been greatly improved.

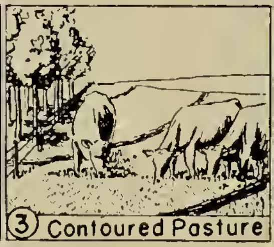
(TOP) NATIVE PRAIRIE grasslands, southwestern Saskatchewan. (Centre) Abandoned land grown over with weeds. Many of the native grasses have almost disappeared through unwise cultural practices, their places taken by rank species unfit for pasture. (Bottom) Same field as above after being sown to crested wheat grass (Agropyron cristatum).

RAINDROPS—Their journey to the sea should be a slow one. Unless properly controlled, water which runs off the surface of the land may cause injury through carrying into rivers and lakes the rich topsoil of agricultural land and by causing disastrous floods.

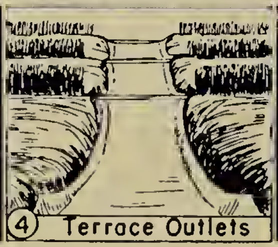
① Woodlot Management



② Strip Cropping



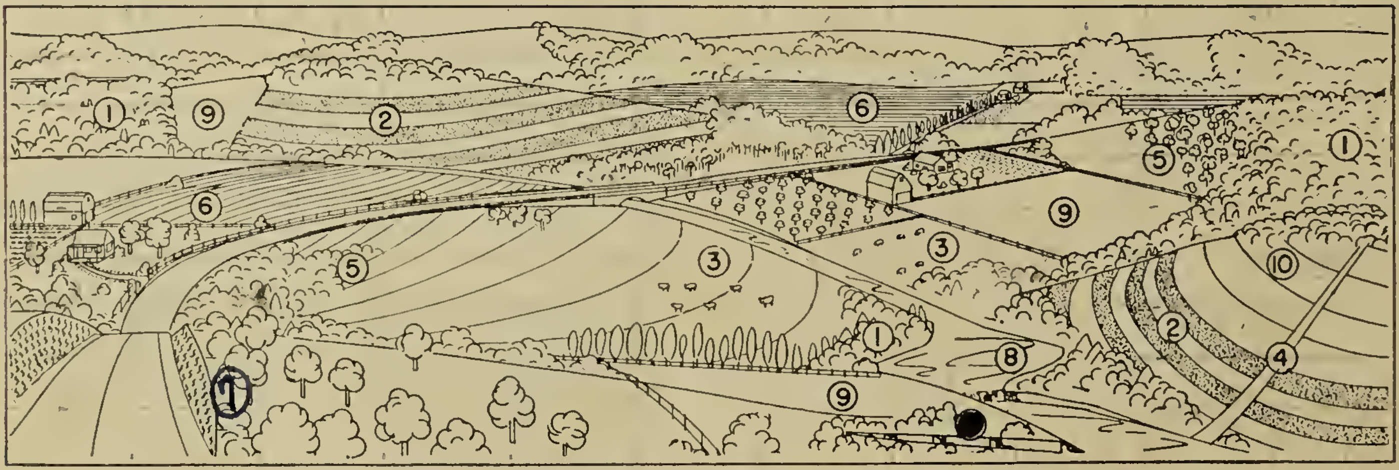
③ Contoured Pasture



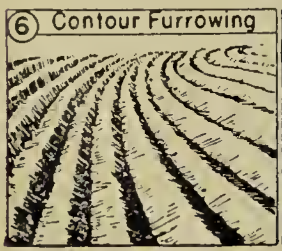
④ Terrace Outlets

⑤ Wildlife Conservation

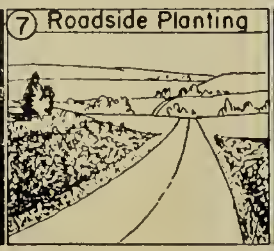
WHAT FARM PLANNING MEANS—AT A GLANCE



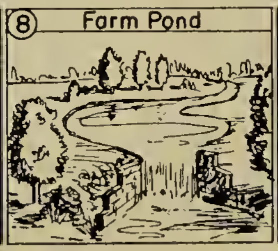
SOIL CONSERVATION SERVICE



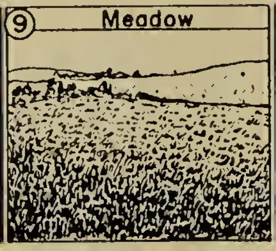
⑥ Contour Furrowing



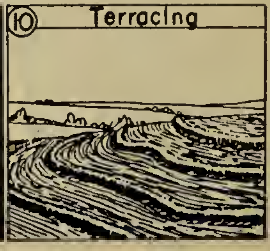
⑦ Roadside Planting



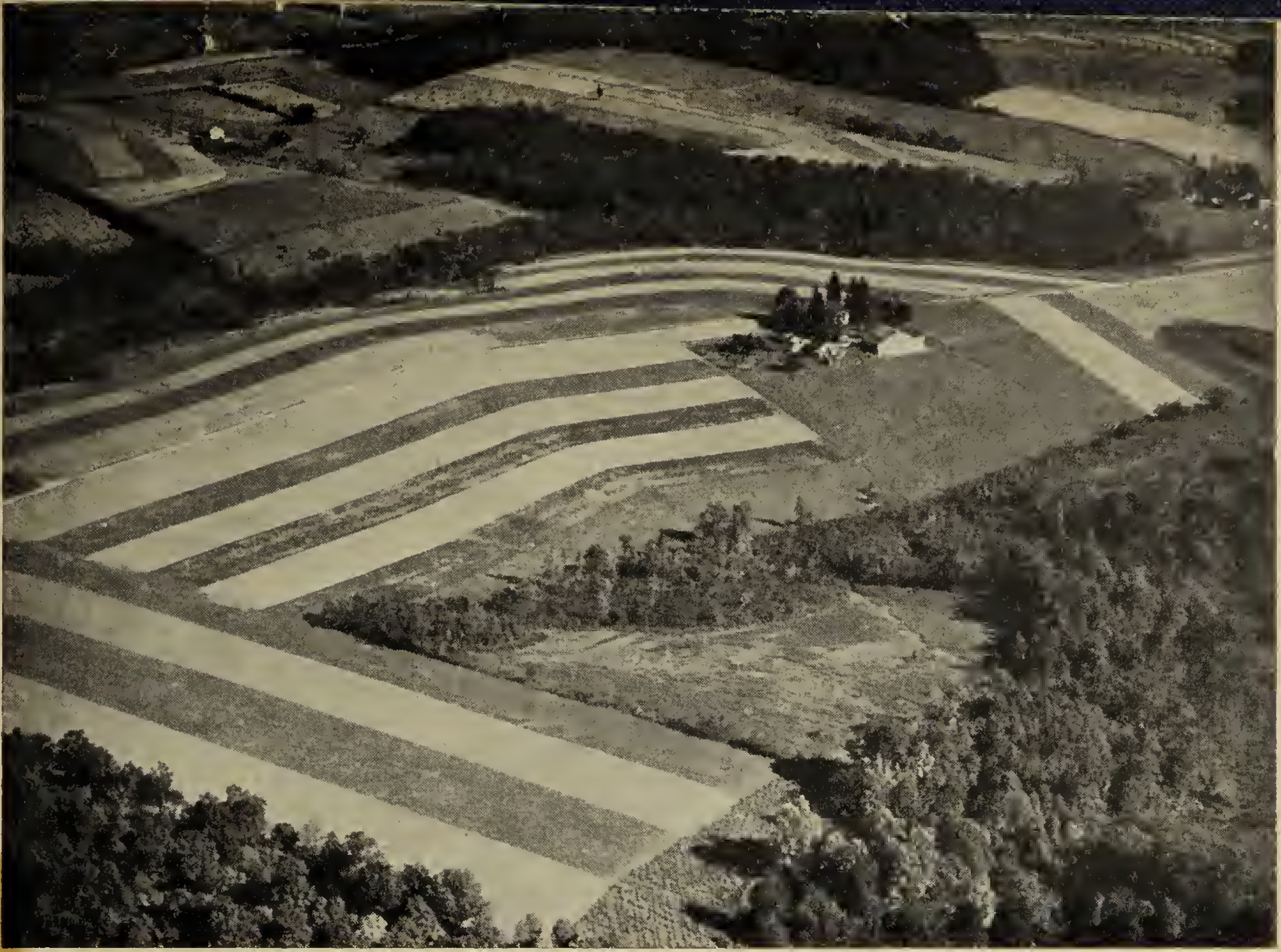
⑧ Farm Pond



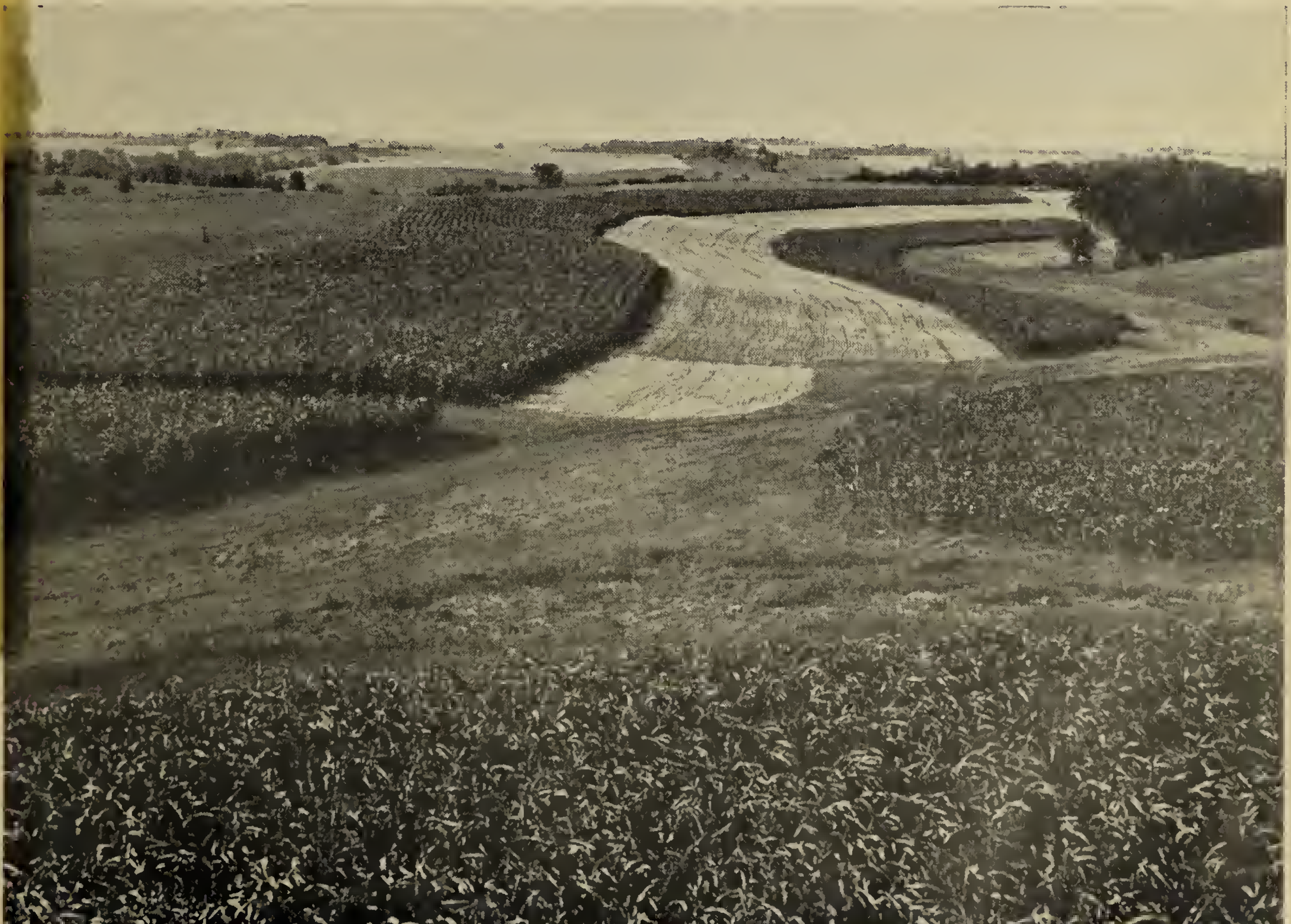
⑨ Meadow



⑩ Terracing

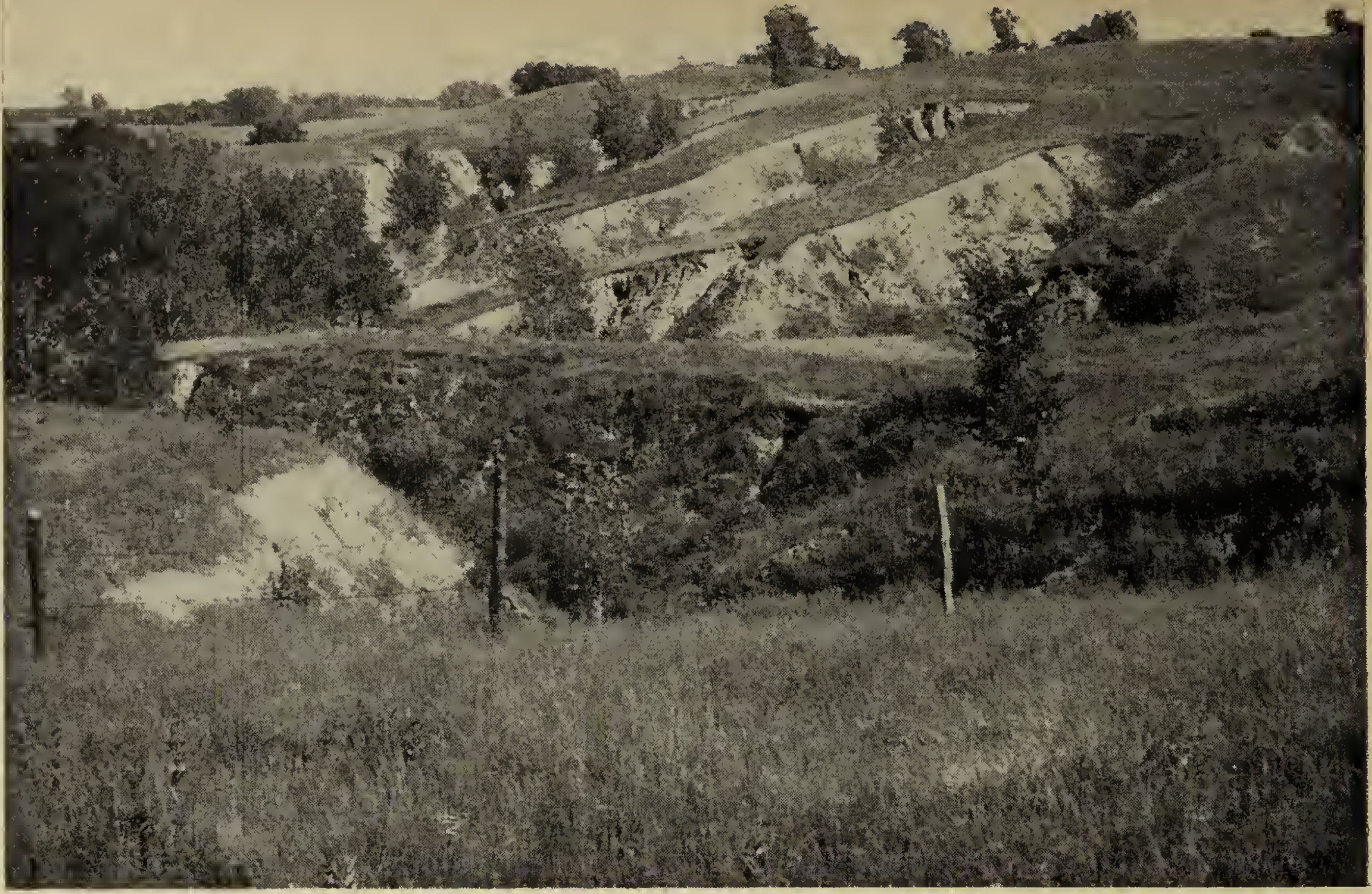


THE NEW LAND PATTERN—field and woodland in perfect proportion. (Below) Strip cropping. On sloping land strips of a clean-hoed crop such as corn are alternated with strips of a close-growing crop such as alfalfa, along contour lines. The object is to impede the flow of escaping rain, divert excess water into thickly grassed drainage courses leading to streams.

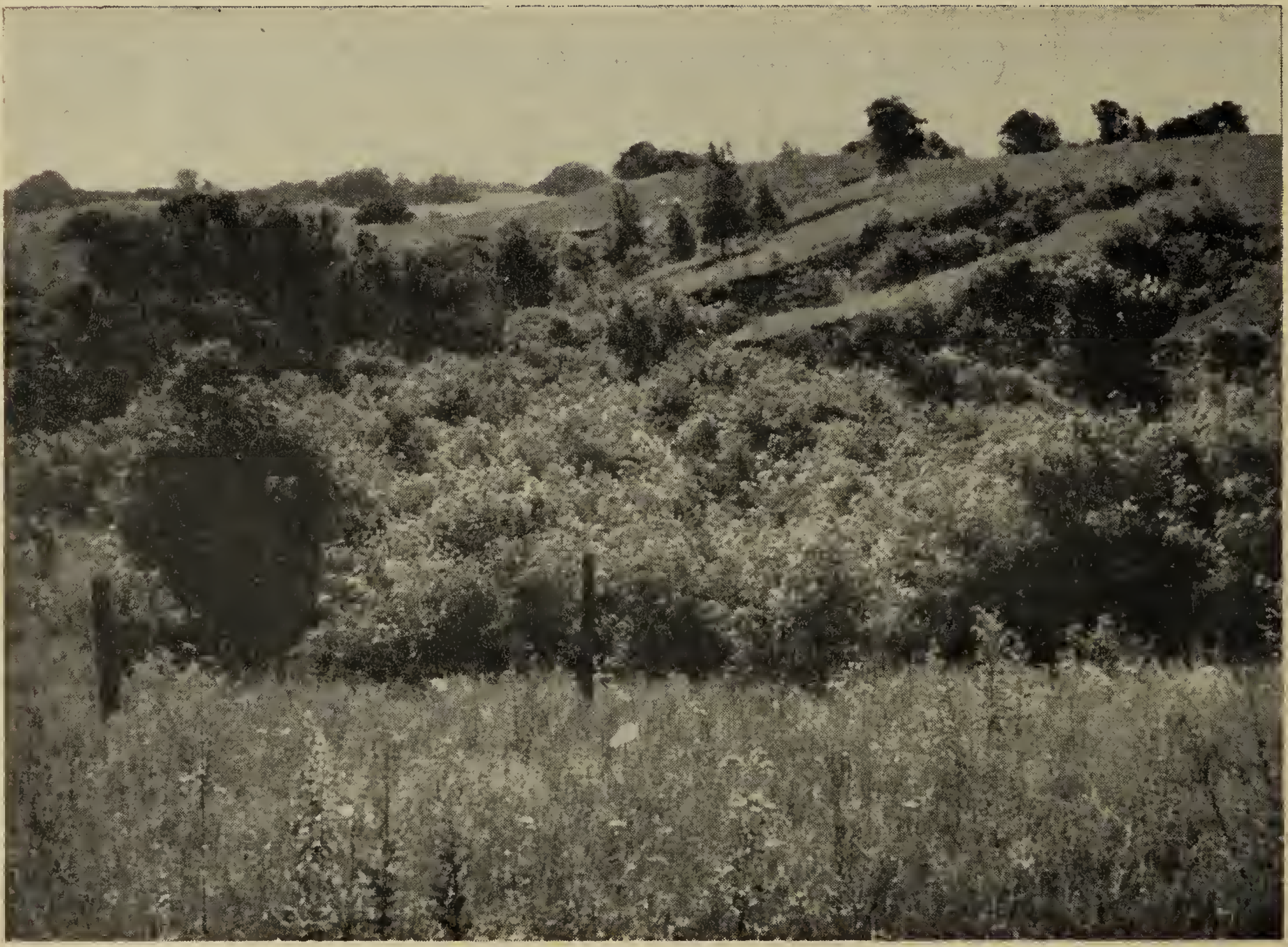


PLOUGHING ON THE CONTOUR is easier on man and horses, requires less fuel for tractor, and increases crop yields 20 per cent and over by minimizing water runoff and washing away of topsoil. (Below) Happy aftermath of heavy rains. Curving lister ridges prevent rapid runoff, preventing erosion and favouring absorption of water for use by the growing crop. Lister ridges are produced by a double mold-board plough which throws out a furrow of earth both ways.

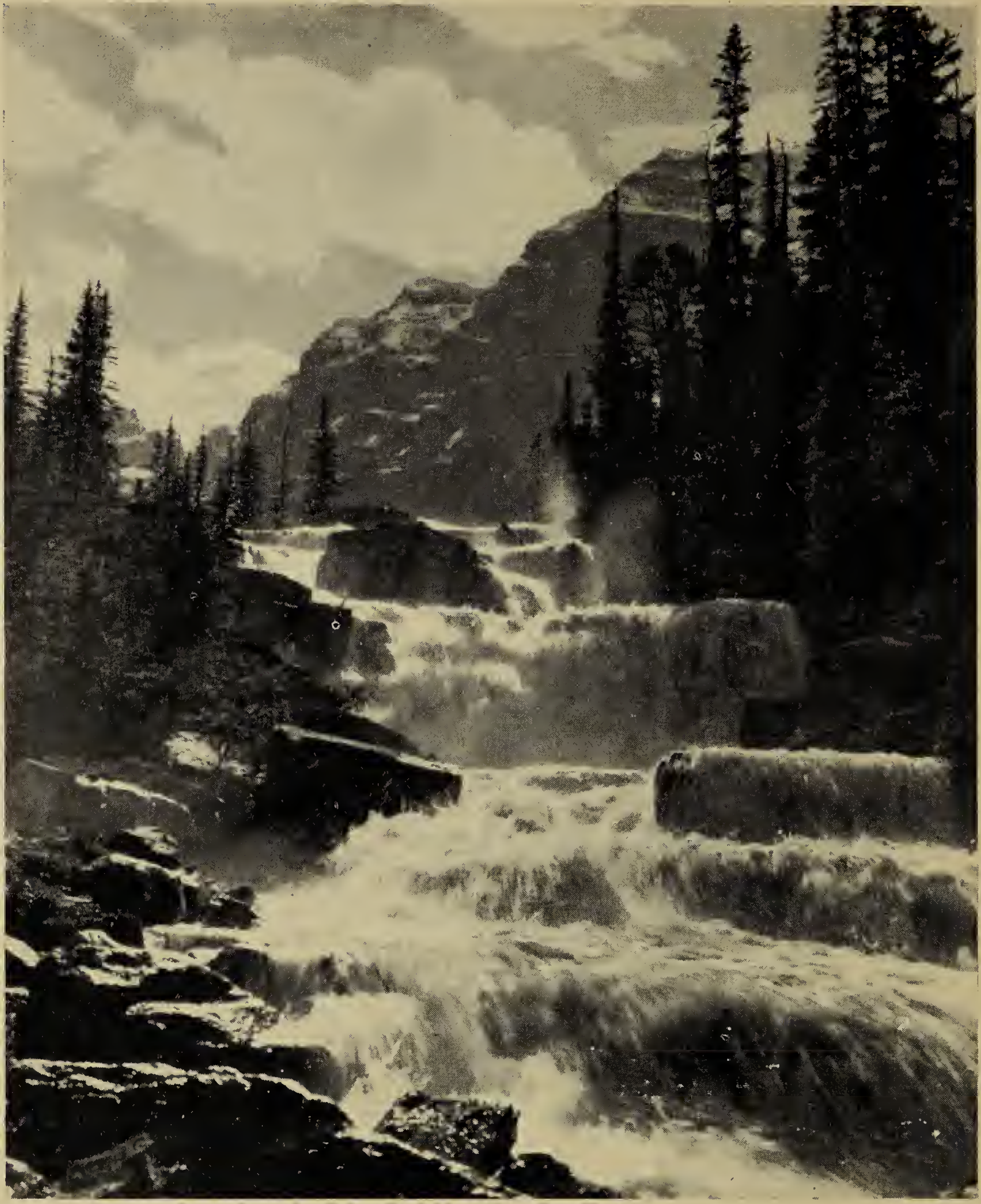
BUILDING TERRACES with power equipment. These are like broad, shallow steps on the steeper slopes where the soil is loose. After heavy rains, water and soil are held and excess water is diverted to well-grassed outlets. (Below) Gully control. Small check dams, built of stones, logs, fence-wire and straw, or whatever material is handy, compel the water to walk, not run, and as it walks to deposit its load of precious silt and to sink slowly into the ground.



A MAZE OF DEEP GULLIES destroying a farm. This area was planted to desirable quick-growing trees and shrubs. (Bottom) The same place three years later. Erosion is being controlled. a potential supply of fence posts exists, and wildlife environment has been established. Natural law works with equal zest to create a desert as to build a paradise. We thrust the lever either to the right or to the left, and it follows along with almost luxurious extravagance.



WHEN WATER RUNS UNCHECKED down steep unprotected slopes, gullying results. Gullies of this size deepen very rapidly by waterfall erosion. Water flows more rapidly downhill. When the speed or velocity of running water is doubled it becomes four times as effective in scouring the soil surface, loosening soil particles, and carrying them away. The amount of soil and other particles that water is capable of carrying in suspension is increased 64 times when the velocity is doubled! This explains why coarse gravel, large stones and other debris are often found in gullies and in the beds of streams. Slopes of the kind shown above are useless for cultivation and should be left under trees permanently. (Below) The beaver makes ponds by damming streams, thus storing water for slower, more even distribution through the year, preventing floods and droughts.



SOIL, WATER, SUNSHINE AND AIR—these are the essentials of life. Without them there could be no life, no plants, no animals. These are the gifts of nature, these are the greatest of natural resources. Air to breathe, sunlight for the higher forms of animals and plant life, soil to provide the essential materials for food, clothing, and shelter, and lastly water, for without water, plants and animals, including man, could not live. Sunshine and air man cannot touch; soil and water he can and does displace, with disastrous results. Soil must stay put and accumulate its riches from the vegetation which holds it. Water must move slowly through its eternal cycle—earth to heaven, heaven to earth. Soil and water need each other. Without water the soil is a desert. These are our treasures; let us so regard them and use them wisely.

Water - - - A National Treasure

A. F. COVENTRY and J. R. DYMOND

WATER is the life-blood of the earth; without it life is impossible. In the absence of water the richest soil is a desert. It is not the lack of plant nutrients but the lack of water that makes deserts of great tracts of the earth.

THE NEED FOR WATER

One of the primary uses of water is to dissolve the mineral elements of the soil so that they may be taken up by the roots of plants. Unless water is available the nutrients of the soil are not available to plants. The amount of water needed to grow crops is not generally appreciated.

Annual plants are about three-quarters by weight water. The amount required by different plants to produce a pound of dry matter is said to vary from 270 to 576 pounds. The average land animal is about 80% water. A pound of beef requires for its production, directly and indirectly, between 15 and 30 tons of water. A very large amount is therefore required to produce the plant and animal food required by each human being per year. When to this is added the amount he drinks and uses in bathing, washing his clothes and in other ways, the total must be truly enormous.

THE WATER CYCLE

Water is always going somewhere.

"All the rivers run into the sea, yet the sea is not full;

"Unto the place from whence the rivers come, thither they return again."

Water that falls as rain or snow runs off, evaporates, or sinks into the ground. All of it eventually returns to the lakes or to the sea whence it is evaporated into the air and ultimately falls again as rain or snow, following the continuous routine known as the water cycle, or hydrologic cycle. Water does not usually return directly to the lakes or sea, but often evaporates from the surface of the ground or is transpired through the leaves of plants, and falls again as rain, snow or hail many times before completing its cycle.

Unless properly controlled, water which runs off the surface of the land may cause injury through carrying into the rivers and lakes the rich topsoil of agricultural land and by causing disastrous floods. If too high a proportion of the precipitation is carried away as runoff, too little may be available for crop production.

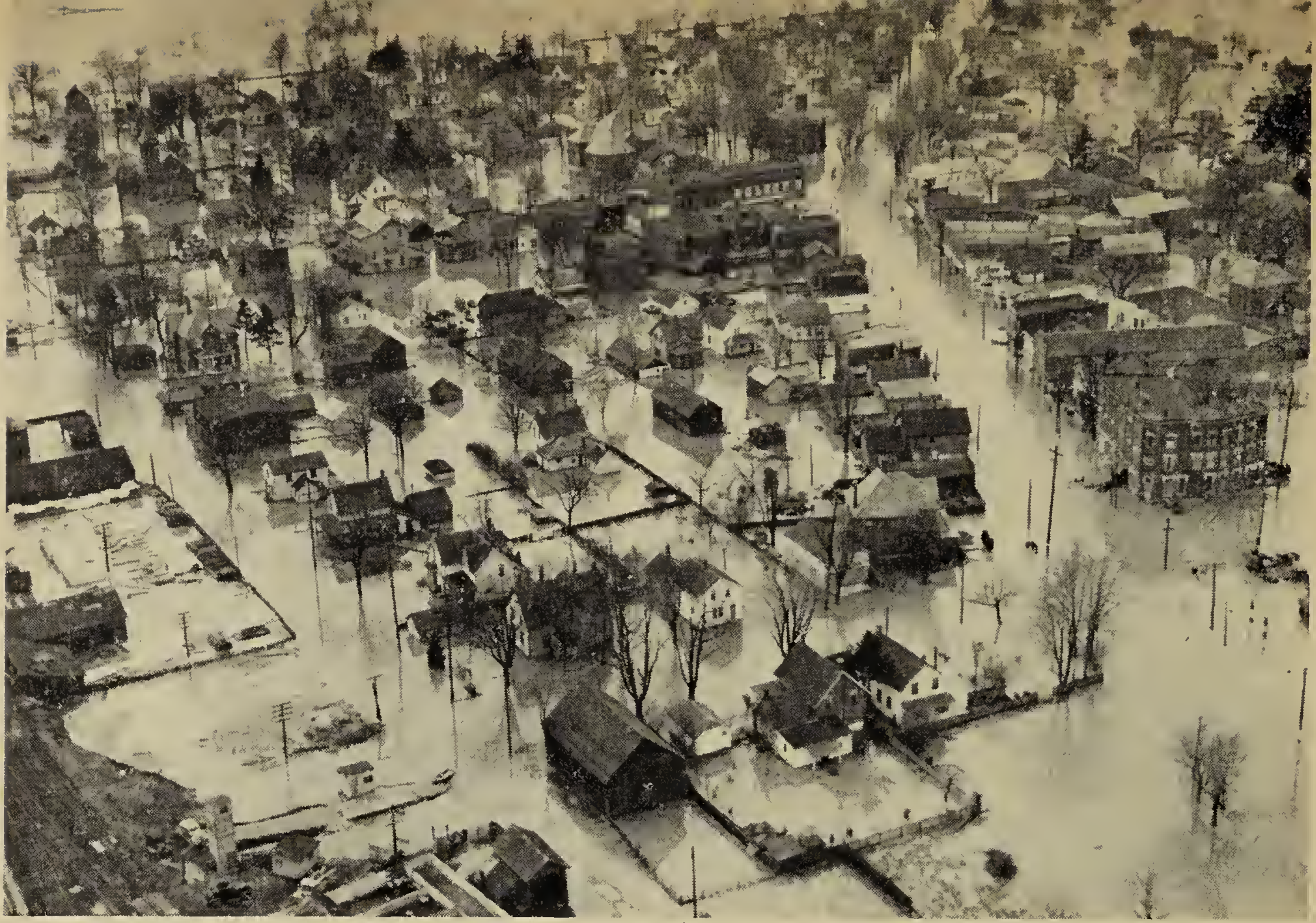
IS THE COUNTRY DRYING UP?

While it may be an exaggeration to warn that areas of Canada's once fertile farm lands are drying up and may become deserts, there is so much truth in the idea that complacency about the continued fruitfulness of our agricultural areas would be a grievous mistake.

In many agricultural regions the removal of the forest and the cultivation of the land has led to a profound change in the water supply. For only a few areas are there anything like accurate figures to indicate the extent and nature of the changes, but a survey of King Township in York County, Ontario, showed that the 200 miles of permanent streams which originally ran in the township, had been reduced to less than 30 miles and that 17 per cent of the wells went dry in summer. A survey made in the region between Toronto and Dundas showed that 67 per cent of all the streams in an area of 1,300 square miles no longer flowed continuously. On some of them, now dry or reduced to a meagre flow in summer, remains of mills and dams indicate that formerly water was sufficient to provide power for grist and saw mills. The desiccation of Western Canada is evident in dried-up wells, sloughs and lakes.

FLOODS

The failure of streams in summer in such areas as agricultural Ontario is correlated with floods, especially in the spring thaw; indeed the summer shortage is the direct result of the too rapid runoff in spring. When forest covered the land, the snow in spring melted more slowly than now in the open. There is sometimes as much as three weeks between the disappearance of the snow on cultivated land and in the nearby woodlot.



In 1950, floods caused Thamesville to be called the Venice of Western Ontario. Nearly every street was a canal, including No. 2 Highway, which jogs westward across picture from lower right. But no gondolas were visible! (BELOW) Between Thamesville and Chatham was this section of inundated farmland, with buildings cut off for acres around by muddy waters.

Water formed on frozen fields can only run away, and often, in the course of a few days, many inches of snow will vanish as water to the nearest stream-bed, which, having been carved out under different conditions, is not big enough to carry this flow, and damaging floods are the result. There have always been floods, of course, even in areas covered by forests, but increase in volume and rapidity of runoff have increased the height of floods and the velocity of the flood waters.

Some appreciation of what is involved in a spring flood in an agricultural area is afforded by the following information for the West Humber River in southern Ontario during a flood in March 1942. During the sixteenth, and the early hours of the seventeenth, a total of 1.45 inches of rain fell on ground still partly frozen and patched here and there with snow. At 11 a.m. on the seventeenth, the volume of water passing down the West Humber was about 4,000 cubic feet a second; it had been considerably greater a few hours earlier. At this rate of flow about half of all the water that fell on the basin of the West Humber was in Lake Ontario twelve hours after the cessation of the rain. The water was opaque with sediment; it is impossible to say how much soil was actually removed by the whole action of the flood, but it is known that at 11 a.m. soil was being carried downstream at the rate of some 2,700 tons an hour. In the summer of 1941, an unusually dry year, the West Humber at this point was completely devoid of flow for weeks on end; at the end of September, 1942, after an unusually wet period, there was less than one cubic foot passing this point each second.

Erosion

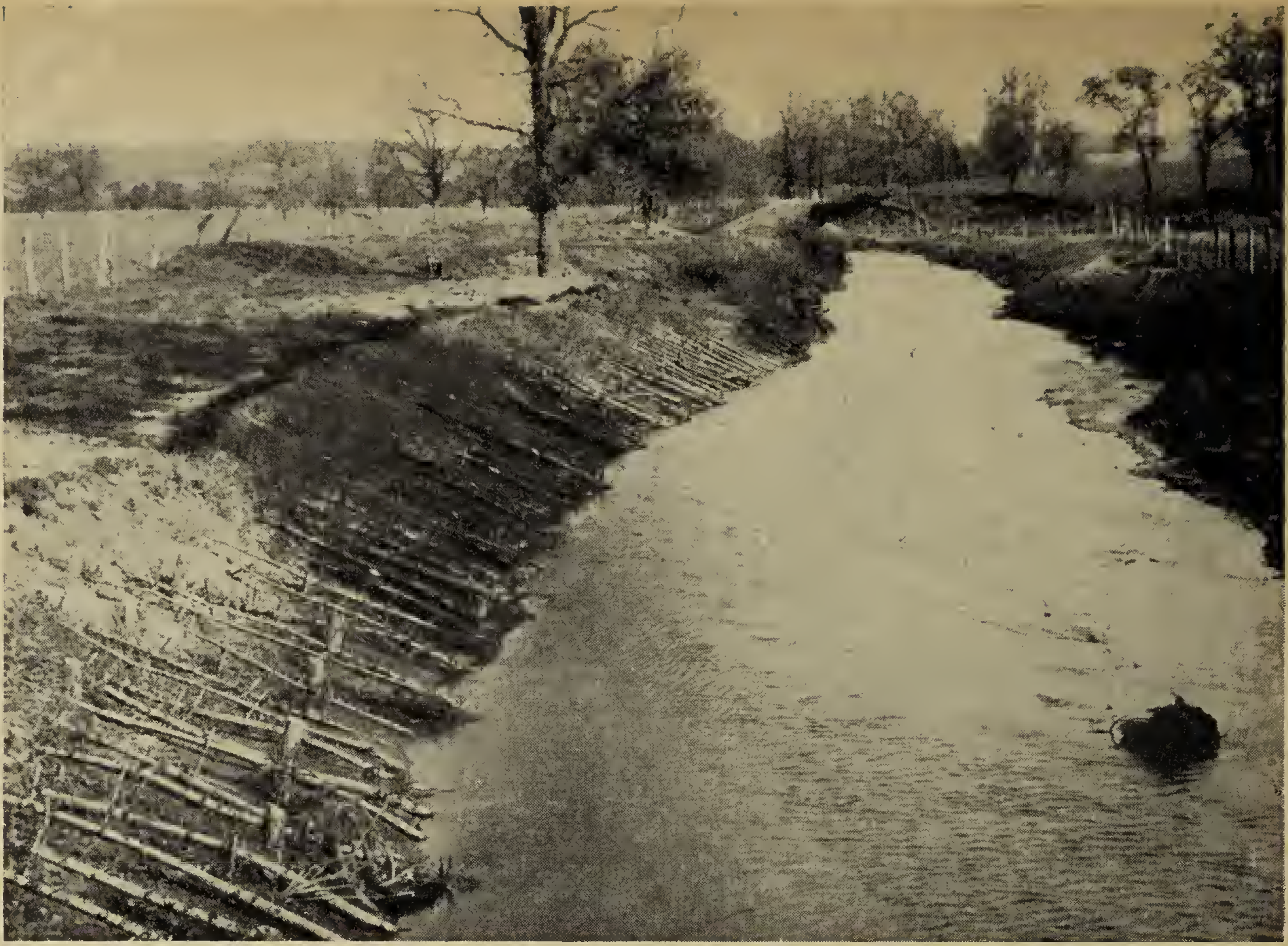
To the evils of desiccation and floods must be added that of erosion or the loss of the soil itself, the ultimate cause of which is exposure of the land by unwise removal of cover, often aggravated by unsuitable agricultural procedures. As this subject has been considered in the chapter "Soil and Wise Land Use" it will not be discussed further here, except to draw attention to the fact that the precious topsoil washed from the farmers' fields silts up streams and lakes to the detriment of many species of fish. Sometimes so much soil is deposited in lakes that dredging is necessary in the interests of navigation.

Destruction of Fish Habitat

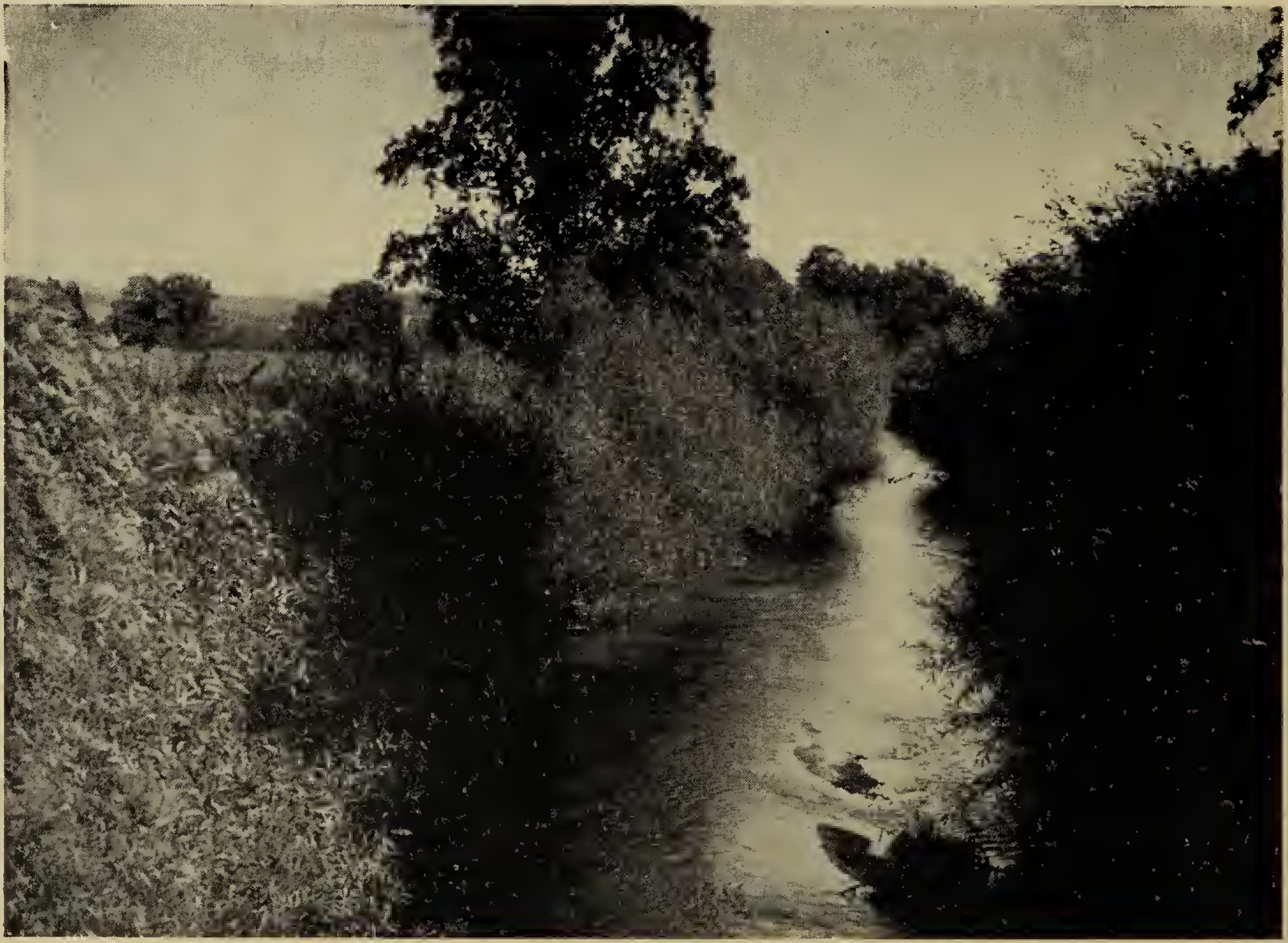
Floods and erosion are not only agents of destruction to agricultural lands, but they are injurious to fish in streams. As a result of so much of the winter and spring precipitation being carried away as floods instead of seeping into the ground, many streams which once ran as spring creeks all the year round shrink to mere trickles or dry up altogether in midsummer. The water in these shrunken streams is also much warmer than it once was, partly because there is less of it, and partly because it has been robbed of the shade of the woods through which much of it once ran. Both the lessened volume and the higher temperature are detrimental to such fish as trout. Moreover, the sediment eroded from the fields silts up the stream bed, at once killing many of the smaller animals which once served as food for fish and making the stream unsuitable as spawning places for game fish. Another factor destructive to our streams as fish habitats is the practice of pouring sewage and various waste materials from factories of many kinds, into them. The volume of these harmful substances has increased almost in direct proportion to the shrinkage in the volume of the water in the streams, thus steadily increasing the strength of the pollution. Many of our streams have thus been made quite impossible as homes for fish.

Ground-Water

Of the water which enters the ground after rain or the melting of snow, some is absorbed by the upper layers of the soil, while some percolates through the upper layers into a great reservoir known as groundwater. Ultimately the water which soaks into the ground reaches rock into or through which it cannot penetrate. Gradually it saturates the materials above. The top of this zone of saturation is known as the *water table*. If the water table is not too far below the surface, it supplies the topsoil with sufficient moisture for the needs of growing plants, in much the same way as potted plants are watered by placing the pot in a dish of water. When, however, the water table has shrunk too low through too rapid runoff, crops suffer, springs fail and wells must be dug deeper. If the supply of ground water is used up faster than it is replenished, the water table will gradually sink lower and lower. This is what has been happening



THE TREATMENT OF STREAM BANKS is simple and inexpensive. A severely eroded stream bank is sloped. Willow poles and cuttings are the next step. Then nature goes to work. (Below) The same site three years later. Streamside vegetation shades the stream, makes cool habitat for fish, holds the banks in place, and provides home, cover and food for birds.



HEDGEROWS, as well as helping to check erosion, and protecting crops from wind, provide an environment useful to wildlife. They likewise furnish travel lanes, shelter and food for insectivorous birds. Trees such as oak, locust, white cedar, wild plum, cherry or hawthorn, shrubs such as sumach, wild rose and snowberry, vines such as wild grape, blackberry and raspberry, are especially attractive, and help to keep fruit-eating birds out of the orchard. (Below) Natural or artificial farm ponds bordered with vegetation make a good wildlife refuge, and recreation for the farm family as well. Soil conservation and wildlife conservation go hand in hand. When all farms are properly treated for conservation of soil and water, one result will be 100% increase in bird life. Recent studies show nearly twice as many ground-nesting birds in a strip-cropped area as in a comparable non-stripped area.

in many agricultural areas not only in Canada but throughout America. In Canada we have practically no definite figures on the extent to which our ground waters have been lowered, but there are observations for the United States which suggest the sort of thing that has undoubtedly happened here. Over an area of 500,000 square miles in the eastern part of the United States the level of groundwater has been lowered as much as five to thirty feet since the country was settled by the white man. This trend cannot continue without serious consequences to life in the areas concerned.

Drought

There are few parts of the country where rainfall during the growing season is sufficient to meet the need of the growing crops. They are largely dependent on ground-water accumulated in the soil at other seasons of the year.

It has been estimated that under Indiana conditions 20 inches of water are required to produce 100 bushels of corn per acre. The average total rainfall for Ontario during the growing season from April to September inclusive, based on records from 1882 to 1942, is 15.7 inches. Precipitation in parts of western Cañada is only from one-third to one-half that in many parts of the east. A considerable proportion of summer rainfall is lost through runoff, resulting from the fact that much of it comes in the form of thunderstorms and other heavy rains which are conducive to rapid runoff from cultivated fields. When such losses, and those from evaporation by hot, dry summer winds, are taken into consideration, it is realized that the moisture available for crop growth is much less than the summer precipitation would indicate.

When too high a proportion of precipitation escapes as runoff, inadequate supplies are stored to meet crop needs during the growing season. This emphasizes the necessity of maintaining an adequate supply of the ground-water so absolutely essential to crop production.

Deforestation

The principal cause of the evils thus far outlined—floods, erosion, drought and the destruction of streams as homes for fish—is unwise land use. One of the common mistakes in land use is trying to farm land that should have been left in forest. The removal of trees from light, sandy land, especially on slopes, has so exposed the soil to the eroding effects of wind and water that it is not unusual to find as much as three or four feet of material have been blown and carried away, leaving little but useless subsoil. The stuff that has been blown away has in many cases seriously depreciated the quality of neighbouring lands. There are many acres of this utterly useless land in agricultural areas and perhaps in other parts of Canada which could be made productive by tree-planting.

That there is a connection between trees and water is indicated by such cases as that in which the removal of five acres of woodlot was followed by the conversion of a permanent flow which drove a grist mill, into a temporary stream. On the other hand, the water supply of a village obtained from springs at the side of a nearby hill, began to fail as the bush was removed but was restored when the woodlot was added to and protected.

Drainage of Swamps and Marshes

While the drainage of some wet lands has added to the area of good agricultural land, the drainage of others has not only involved financial loss but has seriously lowered the water table in the surrounding country. Marshes and swamps act as reservoirs in which water collects at certain seasons and from which it seeps slowly into the underground store of water throughout the year. Many marshes feed the springs at the headwaters of streams, which fail when the sources of their water supply are drained.

Drainage on any large scale should be undertaken only after careful investigation of the initial cost, the upkeep, the agricultural value of the land, the effect on the water table, the possibility of creating flood hazards elsewhere and the other values of the land—for forests, wildlife, recreation and other uses. If this had been more carefully done in the past, many drainage schemes would never have been undertaken.

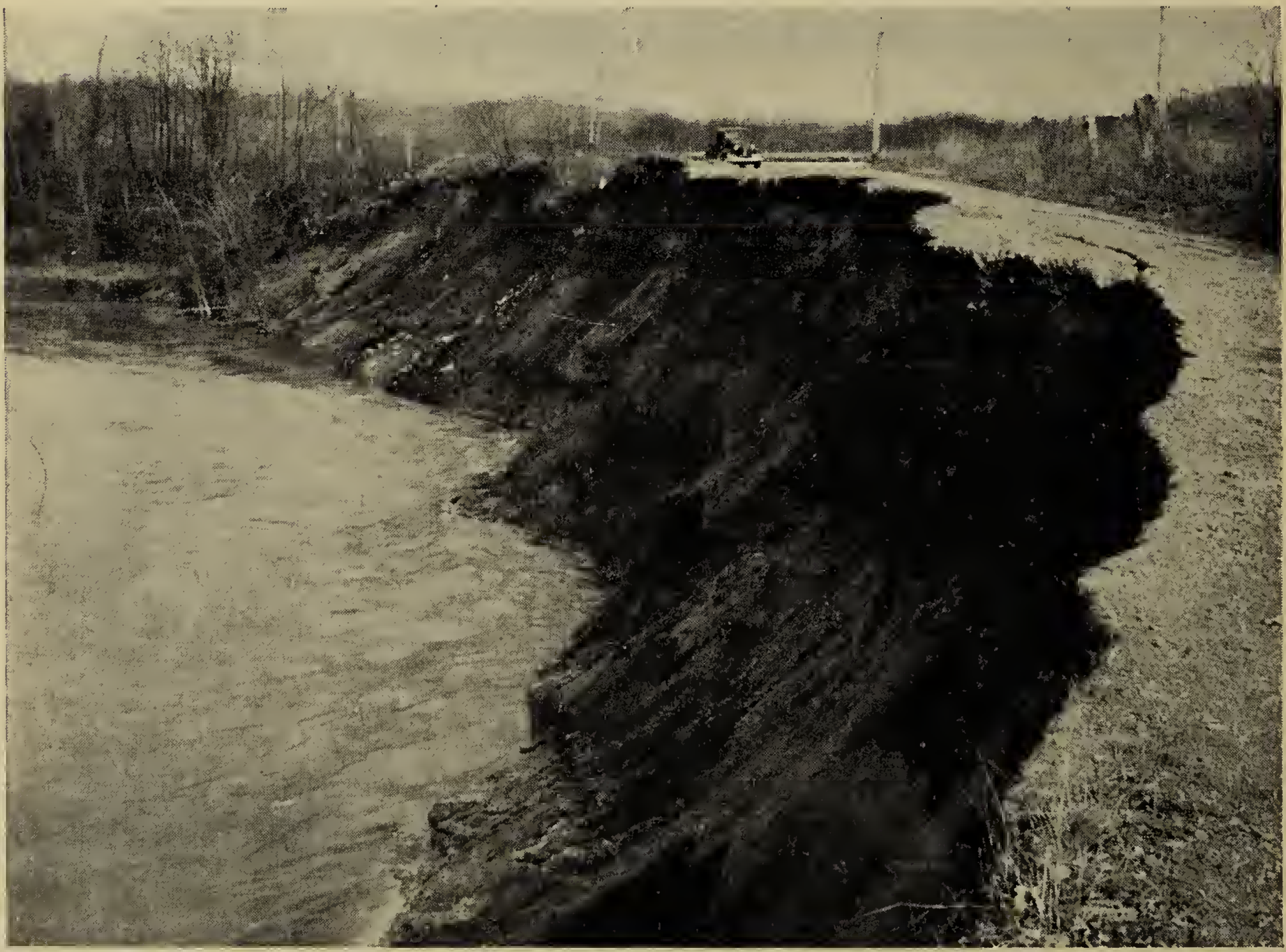
Water Conservation Measures

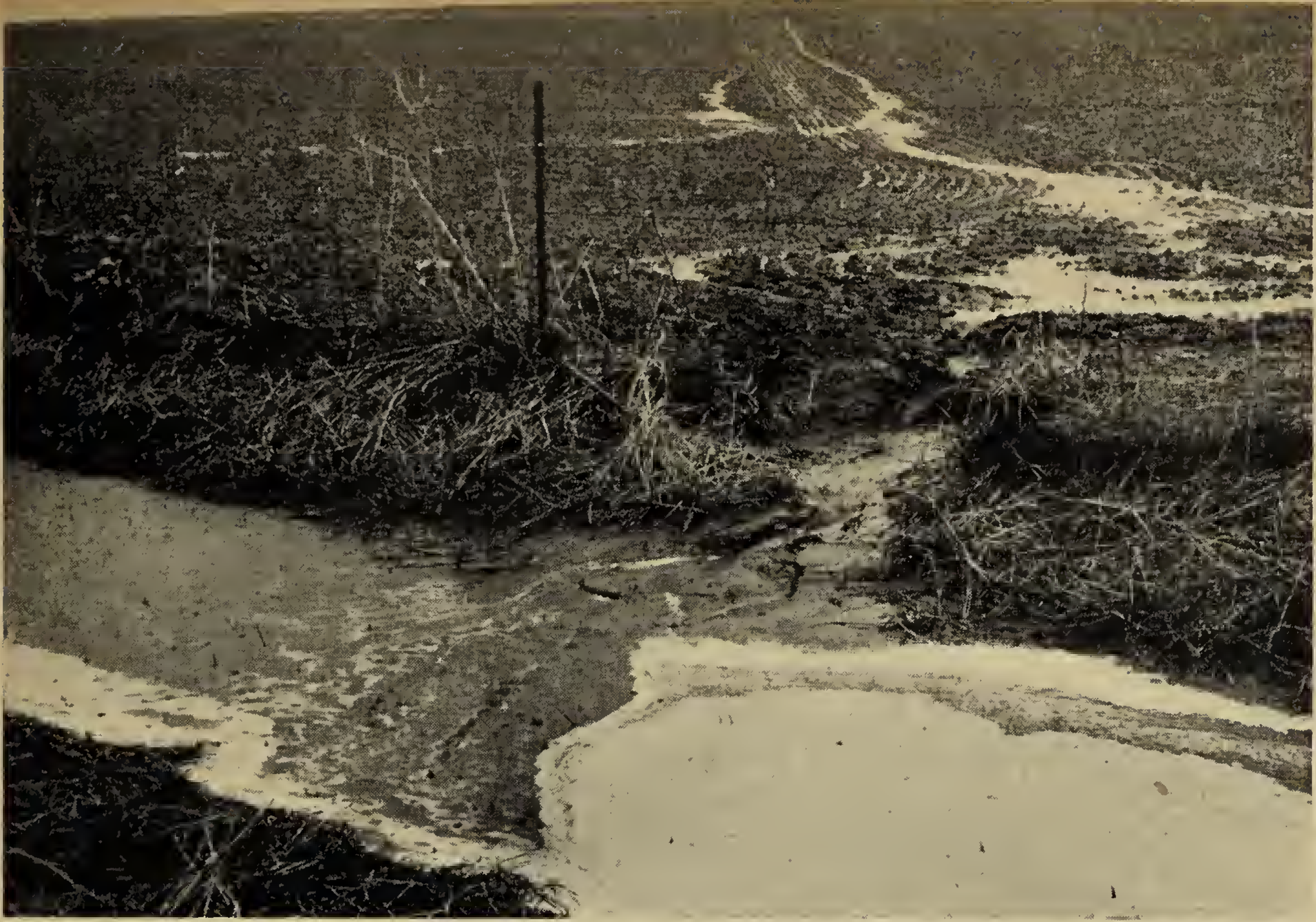
Since uncontrolled water is responsible for much soil loss, the methods already described for soil conservation are really measures for water control. These include using the land for the crop for which it is best fitted—trees, pasture and hay, or cultivated crops. When lands which should grow only forests are covered with a good growth of trees, when

PROPER CONTROL OF EROSION on watersheds prevents silting of stream beds and thus improves fish habitats while vegetation used to protect stream banks aids in producing ideal conditions for fur bearers and waterfowl. Swamps and marshes collect water in times of abundance and permit it to seep gradually into the ground where it adds to the underground store of water which is so needed to support growing crops and to feed springs and headwater streams. As homes for wildlife as well as stabilizers of water, swamps and marshes are often worth more in their natural state than when drained. No marsh or swamp should be drained until careful enquiry has indicated that the land thus made available for agriculture will outweigh the loss to water storage. Indiscriminate drainage cannot go on forever, for there will soon be no swamps or marshes left. Millions of acres of water have been hurried off the land, hurried to the sea before their time, before they have been of enough use to plants, beasts, birds or man. Remember that drainage also lowers the water table in the surrounding country, robbing growing crops of necessary moisture.

IT IS OFTEN WISE for farmers to build ponds. This can be done by simply throwing earth dams across the larger water outlets and sodding the dams. A well-managed farm pond stores water from times when it is abundant for use when it might otherwise be scarce. Livestock and domestic waterfowl are ensured a permanent watering place and wildlife are attracted by it.

SITES SUCH AS THIS, unsuited to cultivation, pasture or woodland, should be left in a natural state to serve as fish and wildlife habitats. (Below) Erosion of unprotected stream banks destroys property and ruins the stream as a habitat for fish. Such a condition is usually produced by overloading of the river channel during spring thaws and periods of heavy rain.





WATER RUNNING from wheat land during ¾-inch rain. Notice concentration of water in drill marks on this gently sloping field. If cultivation had been across the slope erosion would have been lessened and more water would have sunk into the soil and raised the level of groundwater. (Below) When flood water recedes, a heavy coating of mud and silt covers planted fields.

western ranges in areas of insufficient rainfall and fields too steeply sloping for cultivation are maintained in permanent pasture and not over-grazed, and when crop lands are managed in accordance with proper soil and moisture conservation principles, we shall have gone a long way towards preserving a proper balance between the water that falls as rain or snow and what is needed to maintain a healthy land.

Reforesting light and waste lands which should never have been stripped of their trees and the protection of farm woodlots are especially important. A well located farm pond to store water from times of abundance for periods of scarcity is a good water conservation device.

Desirable types of water conservation measures have been admirably demonstrated on the prairies under the Prairie Farm Rehabilitation Act (P.F.R.A.). These have included re-grassing lands that have been found unsuited for farming purposes owing to soil and climate conditions and developing over 30,000 small water projects such as dugouts, dams and irrigation.

On some rivers, dams must be built for holding water which would otherwise run away as damaging floods in spring, and storing it for use in summer when otherwise water would be scarce.

The most famous example of river control in modern times is the Tennessee Valley Authority (T.V.A.), set up to stop the destructive floods of the Tennessee River and its tributaries, and to turn the power of the river to public use. Since 1933 sixteen vast dams have been built and thirteen acquired from former owners. These are centrally operated on a coordinated plan, covering a watershed of 40,000 square miles.

All this tremendous engineering would become useless, however, if farmers' fields continued to erode, filling reservoirs and channels with silt. So the T.V.A. men go back to the land to encourage farmers to cooperate in saving the soil. Tens of thousands of farmers have voluntarily signed up, and a plan for each farm has been worked out. Basically the idea is to keep trees on the steep slopes (plant them if they are not there), keep grass on less steep slopes, confining crops to the gentle slopes and flat lands. One result has been a transformation of the landscape. Seen from the air, it is strikingly beautiful. One can look from a plane and see the Valley's fertility returning!

People living in the valleys of all our major rivers and in valleys all over the world will some day come to do likewise. Here is something too important for humanity to overlook.

Rock Stories and How to Read Them

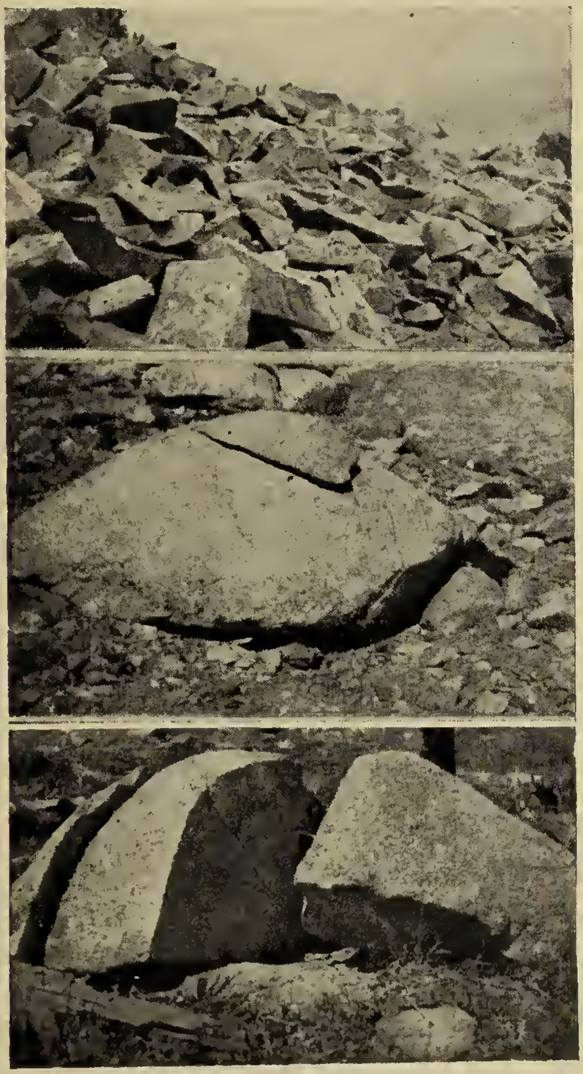
DOROTHY A. TREAT

If you stop to think about it, everything in the world is concerned with rocks. They are the foundation on which we live and build our cities. Rocks constitute the earth itself. They are the raw materials from which soil is made and out of which all vegetation grows. Rocks are composed of minerals. In them are the ores and metals that play such a vital part in our lives.

The most permanent thing in the world is change. We have only to think of the earth and all the life on it to realize the truth of this seeming paradox. In the study of rocks we are particularly aware of this. Although a rock may seem to be something hard and indestructible, actually it is continuously being altered and even huge masses of rock such as mountain ranges, while fairly permanent when compared to a human life span, are mere incidents in the history of the earth. The Rocky Mountains, for example, are new. Before they existed a vast sea occupied the area, and before that there were plains and other mountains and other plains. Those who understand something of how rocks are formed can read these events by examining the rocky walls of river valleys. Fossil remains of plants and animals, now part of some of these rocks, bear evidence of life in the area while these changes were taking place.

Ability to read a little of the story of earth changes in any area is not as difficult as you might imagine. If you can distinguish the more common members of the three great classes of rocks and if you know something of the forces at work to alter them, even though your knowledge be gleaned only from the brief paragraphs that follow, it seems probable that you could go forth wherever you are and read for yourself at least a few of the events in earth history which have happened there.

All rocks exposed to the surface are gradually crumbled by the action of heat, cold, rain, snow and ice. This eroding process is called weathering. It greatly alters the appearance of a rock, softens it and changes its texture. Since all exposed surfaces of rocks (those we usually see) are somewhat weathered, we must obtain a fresh surface in order to observe the true characteristics of the rock. A few sharp blows of a small stone mason's hammer can do this for us. The effect is often startling. A dull, nondescript looking rock opens to display a colourful, sparkling, beautiful interior hidden beneath its weathered surface.



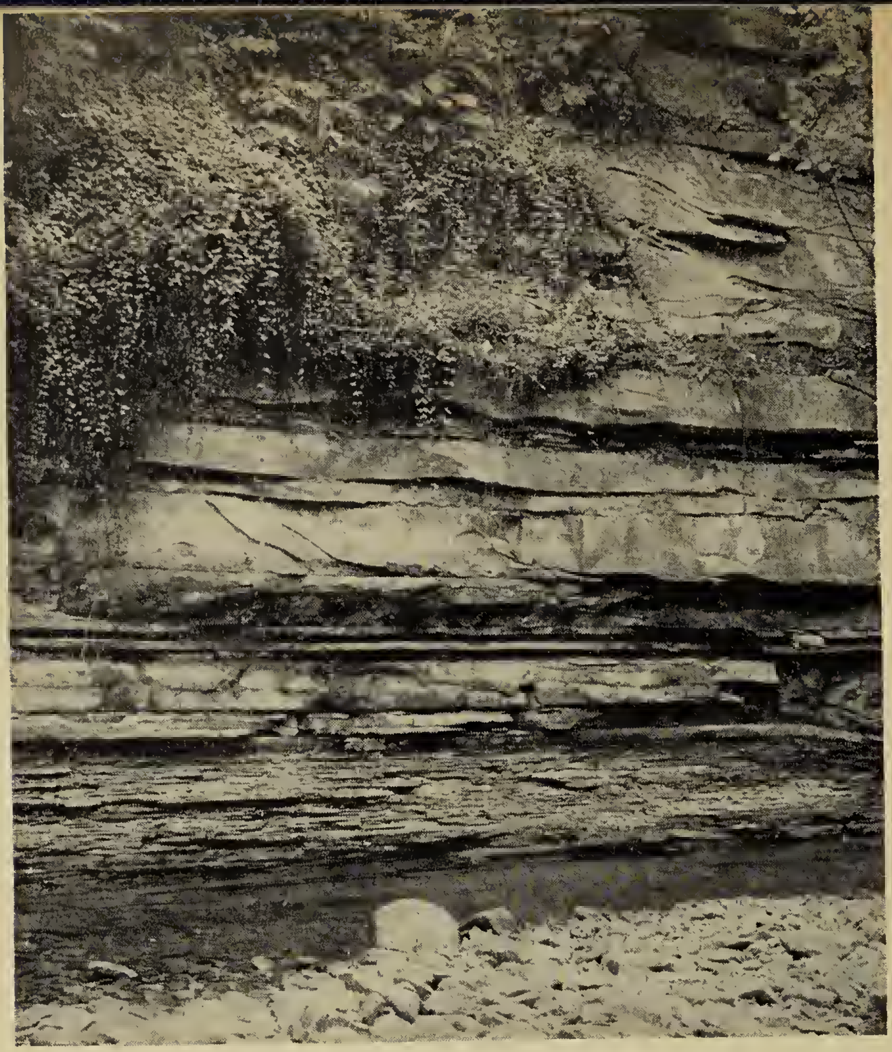
ROCK WEATHERING

1. Rock fragments broken by frost action (heat, cold, water, ice).
2. Gneiss boulder showing exfoliation, a scaling off of rock fragments—typical of metamorphic rock.
3. Granite boulder split by frost. Each winter these fragments are forced farther apart by wedges of ice.

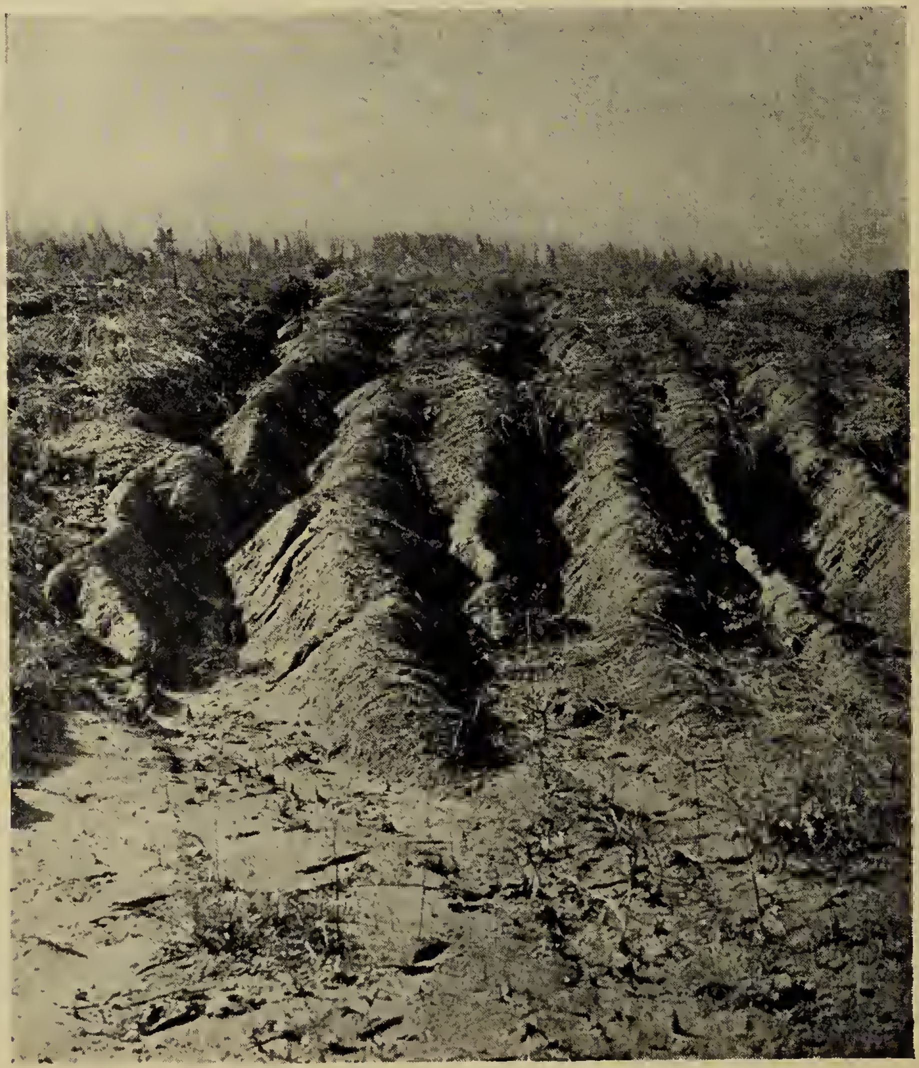
In weathering, hot sun causes a rock's surface to expand. Cold contracts it. But this surface does not expand and contract as a unit since the various minerals composing the rock differ in their degree of expansion and contraction. The result is that the rock begins to crack. Water seeps into the cracks and when it freezes widens the cracks. Water is a great solvent too and may carry off some of the mineral constituents of the rock in solution. In time fragments of rock are broken off and these fragments later become smaller fragments, eventually small enough for rains and the force of gravity to carry off to streams and rivers. As the stream carries along this load of sand and clay, it uses it like a tool to carve ever deeper its valleys, shaped like a giant letter *V*, as it flows to the quiet waters of the sea, where it deposits its load in huge beds of sand and clay. In mountainous areas in the north, great rivers of ice, the glaciers, sometimes carry huge fragments of rock along with a load of smaller boulders, pebbles and finely ground rock, slowly down the valleys to be dropped in big hills when the ice melts. The glacier shapes its valley like the letter U.

Wind too is a great weathering force. It can pick up the finer particles of rock and carry them long distances. It can also hurl them against rock surfaces with such force as to etch them. Some of the curiously shaped rock formations in the southwest are examples of wind sculpture. By the combined efforts of these weathering processes, entire mountain systems can be reduced to plains.

Meanwhile, great pressures within the earth may be lifting these plains to form new mountains. In Colorado near the town of Boulder, we can see great beds of sandstone formed there in an ancient sea, now tipped on end by pressures from below to form the foothills of the Great Divide. Higher, where the sandstone cover has worn off, is the massive granite of the lower mountains. This is the rock which pushed the sandstone up. Still higher where both the sandstone and



In some places river banks and road cuts show layer upon layer of shales and sandstones like a slice through a huge birthday cake. In this picture, the thick massive layers are sandstone, the thin layers at the bottom of the cliff are shale. They tell the story of a vast sea that once occupied the area.



Evidences of rock weathering and changes in the earth's topography are everywhere apparent. Out in the sloping field, gulleys are forming, exhibiting in miniature after a rain how rushing water carrying a load of sand and clay carves for itself an ever deeper V-shaped channel as it winds its way downhill.

granite cover have worn off, are rocks from nearer the bottom of the pile, rocks altered by tremendous heat and pressure, the metamorphic rocks, schists and gneisses that form the jagged peaks of the Divide.

Evidences of rock weathering and changes in the earth's topography are everywhere apparent. Out in the sloping field, tiny gulleys are forming, exhibiting in miniature after a rain how rushing water carrying a load of sand and clay carves for itself an even deeper V-shaped channel as it winds its way downhill. This is the familiar phenomenon of erosion whereby thousands of tons of good top soil are removed from fields man has carelessly allowed to remain unprotected by a cover of vegetation.

A gravel pit reveals the true nature of the area out of which it has been gouged—a mixture of sand, clay and angular pebbles, in the northern part of the country is the dumping ground of a glacier. A fresh road cut shows the nature of the rock beneath. It may be granite, an igneous rock once molten and slowly cooled within the earth, or metamorphic schists and gneisses suggesting an old mountain top, or, in the Great Plains area, layers of shales and sandstones formed long ago within some sea and hiding in them fossil remains of ancient life. Near the top of the road cut are fine fragments weathered from the rock below, the elements of soil. There are rivers dark with mud flowing to the sea where this mud will be dropped, gradually building up great beds of sand and clay, some day perhaps to become great beds of sandstone and shale. In the mountain canyons are walls of igneous rock which, when molten, intruded and pushed up overlying rock. Through it are streaks of other igneous rocks which intruded later, filling cracks in the older igneous rock.

Forests and Forestry

In a country the size of Canada, there is naturally a great variation in climate. This variation is reflected very clearly in the distribution and grouping of the different kinds of trees. Linked up with the climatic effect is what might be called the family history of the species of trees themselves. Great changes of climate have taken place in the past and, just as human beings go from place to place in search of livelihood, so the Canadian trees have moved back and forth with changing climatic conditions. For example, with the advance of the great glaciers during the Ice Age, those tree species characteristic of the sub-arctic and north temperate zones were forced southward, and when the ice retreated they moved north again. The present position of many species of trees can often be explained in this way.

The different kinds of soil and the varying forms of land surface, such as river-valleys, hilltops, and swampy hollows, also have a strong influence. Trees, like men, have likes and dislikes, and try to occupy sites that best suit their needs, or places which they can put up with more easily than can other tree species.

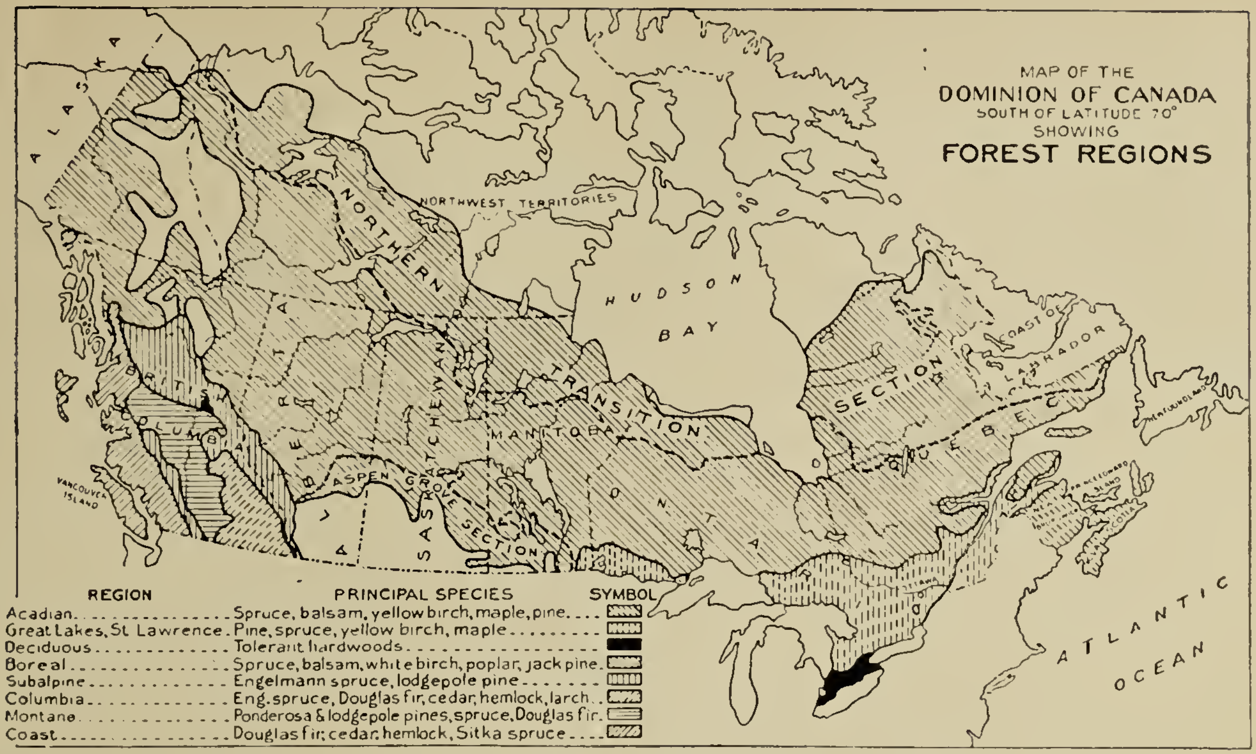
The influences of climate and history and, to a lesser degree, those of soil, topography, and animal life, determine how far a given species will extend over the country in a natural state. This extent is known as its "range". Towards the limits of this range less suitable conditions of climate are usually met with and the tree becomes scarcer and often shows poorer growth.

The general result of these factors is to provide a very natural basis for the classification of the whole country into forest regions. A short account of each region follows:

THE BOREAL FOREST REGION is the largest and probably the most important region in Canada, covering an area of almost 1,700, 000 square miles. The forests of this region provide a large part of the pulpwood used in the pulp and paper industry—Canada's greatest single manufacturing industry. Towards the northern part of the region growth is stunted by the severity of the climate, but the forest has great value as the home of fur-bearing animals.

THE GREAT LAKES - ST. LAWRENCE FOREST REGION lies south of the Boreal forest

A HEALTHY, WELL-REGULATED FOREST. Vigorous, fast growing young trees of the type shown above often produce as much as 1,000 to 1,500 board feet of new wood per acre per year.


MAP OF THE
DOMINION OF CANADA
SOUTH OF LATITUDE 70°
SHOWING
FOREST REGIONS
NORTHWEST TERRITORIES
NORTHERN
TRANSITION
SECTION
HUDSON BAY
COAST OF LABRADOR
QUEBEC
MANITOBA
ONTARIO
ALBERTA
SASKATCHEWAN
BRITISH COLUMBIA
ASPEN GROVE SECTION
VANCOUVER ISLAND
ATLANTIC OCEAN
REGION
PRINCIPAL SPECIES
SYMBOL
Acadian . . . Spruce, balsam, yellow birch, maple, pine
Great Lakes, St Lawrence . Pine, spruce, yellow birch, maple
Deciduous . . . Tolerant hardwoods
Boreal . . . Spruce, balsam, white birch, poplar, jack pine
Subalpine . . . Engelmann spruce, lodgepole pine
Columbia . . . Eng. spruce, Douglas fir, cedar, hemlock, larch
Montane . . . Ponderosa & lodgepole pines, spruce, Douglas fir
Coast . . . Douglas fir, cedar, hemlock, Sitka spruce

in the eastern part of Canada. In area it covers around 150,000 square miles. Within this region are some of the earliest centres of settlement and, as a consequence, in many portions the forest has largely been cleared and remains now only as woodlots or small patches on poor soils. The lumber industry of Canada was founded on the extraction of white pine. Although the cut of this tree has decreased greatly in recent years, it is still an important and very valuable commercial tree. Of late years the use of hardwoods is increasing and this source of natural wealth will be much further developed in future.

THE ACADIAN FOREST REGION covers an area of around 45,000 square miles. The characteristic trees are similar to those of the Great Lakes-St.Lawrence region, excepting that red spruce assumes a position of great importance as a commercial species. The lumber industry in the Maritimes has been in existence since the earliest days of settlement. Of recent years important pulp and paper industries have also been established.

THE DECIDUOUS, OR BROAD-LEAVED, FOREST REGION is the smallest forest region in Canada, occupying an area of some 8,000 square miles. It is in reality a northern extension of one of the major forest areas in North America—the great temperate hardwood forest of the Central United States. In this region occur many trees not found elsewhere in Canada, such as black walnut, hickories, and white and black oak. As the area is one of the oldest settled parts of Ontario, only remnants of the forest remain, but these are interesting to nature lovers.

THE COAST FOREST REGION. While this region is comparatively small in area, comprising only some 50,000 square miles, it supports the great lumber industry of the British Columbia coast. This industry produces more than half of the total lumber cut in Canada and its products, in normal times, are shipped overseas to all the markets of the world.

THE MONTANE FOREST REGION, about 55,000 square miles in area, occupies the interior plateau of British Columbia, an area of limited rainfall, which is really a northerly extension of a very important forest region in the Western United States. This is a country where irrigation is necessary, and the watershed protection function of the forest is of great importance. The trees are mostly open-grown, and grasses growing on the forest floor provide summer range for vast herds of cattle and sheep. Small sawmills provide lumber for local construction as well as boxes for an important fruit industry.

The Columbia Forest Region. Between the semi-arid country and the Rocky Mountains proper is a distinctive region of higher rainfall, covering about 20,000 square miles in the southern part of British Columbia. The forests in the valleys and on the lower slopes of the mountains are similar to those in the Coast region, but the trees are smaller and the yield of timber per acre is lighter. The sawmill industry of southeastern British Columbia operates in this region. There is also a considerable production of railway ties and of poles and piling.

The Sub-Alpine Forest Region, in area about 90,000 square miles, is the name applied to the forest on the higher slopes of the mountain ranges in western Canada, from the Rocky Mountains to the Coast Range. In the north the forests of this region form continuous stands and only this part of the region is able to support a lumber industry.

These brief descriptions can serve only to indicate, in general terms, the main characteristics of the different forest regions. Naturally, within each region there will be many variations in the kinds of forest growth. For instance, in one place will be a sand plain, covered with pine; a short distance away may be found a hillside clothed with maple, yellow birch, beech, and other hardwoods. East of the Rocky Mountains mixed forests, containing both hardwoods and softwoods, are commonly found. The forests of British Columbia are predominantly of coniferous species—the so-called softwoods.

Each individual species in a stand strives for dominance and, in so doing, influences the growth of the other trees by competing with them for available food and light. Besides the influence which the trees have on each other, they are affected by the animal, bird and insect populations of the area and, what is less obvious, by the minute bacterial life which thrives within the forest floor. The stand of trees that exists on any site at any particular time represents an equilibrium established as the result of a complex interaction of many natural forces.

Man is the great disturber of nature's equilibrium and has wrought many changes not only in the extent but in the very nature of our forests. For instance, light-seeded trees such as poplar and white birch have come in after fires over large areas in eastern Canada, replacing the more valuable species of the undisturbed forest. Likewise, because of fires, lodgepole pine has covered the slopes and valleys of the Rocky Mountains at the expense of spruce and balsam. Nature is ceaselessly striving to restore the original forests, despite man's actions which, in Canada, have been mostly destructive. Through the application of scientific principles man can exert a constructive force in the forests and direct their growth towards production of the kinds and sizes of trees most useful to him. This, in essence, is the object of the practice of forestry.

How a Tree Grows

The tree that people see—the poetic shape of trunk and branch and leaf—is only part of a tree. There is almost as much tree beneath the ground as above. Anchoring the tree to the earth and tapping the soil for moisture is a huge root system many miles in total length. It wedges deep into the earth, forcing itself around and even through big rocks in its search for water. The shape of the tree's root mass roughly resembles the shape of the tree above the ground. Its roots grow in a circumference which matches the circumference of the tree's outside branches.

The root system extracts an enormous quantity of water from the soil, making the tree a very active waterworks. On a single summer's day a middle-sized apple tree will lift 800 lb. of water out of the ground, spraying all but a small part of that water out into the air. All vegetation, of course, acts as waterworks. A stalk of corn can lift up 440 lb. of water in its growing season, and an acre of lush grass will lift up more than six tons of water on a June day.

Botanists have long puzzled over the tree's ability to lift so much water to such heights. Neither suction nor root pressure fully explained it. Botanists now think that cohesion

2,500,000 ACRES OF FOREST are burned each year in Canada. Records show that careless campers and motorists, and lightning, are the cause of most fires. Destruction of valuable mature trees by fire is a great economic loss, but the aftermath of a burn can be equally serious. Fire, besides killing the trees, often burns away the humus and minerals needed for tree growth. Repeated fires can render the land so sterile that there will be no new tree growth for years. After protecting litter, humus and roots have been destroyed by fire, the topsoil is easily washed away. Forest fires in one afternoon can destroy a century of nature's magic.

Why not strive for a community forest in your district?

IN SOUTHERN ONTARIO many counties have less than ten per cent of woodland and some 135 townships have less than five per cent, whereas in agricultural areas originally forested at least fifteen per cent should be left under trees. Much of the remaining woodland is badly culled and thousands of acres, unfit for agriculture, have been cleared and left abandoned and worthless.

Reforesting such areas would not only produce future timber supplies, but would stop erosion, decrease silting of streams, raise the water-table, provide recreational areas, and generally improve the whole region.

Realizing the need for tree-planting in many sections, the Ontario government maintains three forest stations, whose combined output of nursery stock runs from fifteen to twenty million trees a year. From these stations landowners may obtain without cost young trees to re-stock woodlots or to re-plant waste areas. District foresters are maintained by the government to assist land owners in reforestation projects and in the care of existing woodlands.

As well as many individuals, numerous groups have taken advantage of this government service. Something like a dozen counties have established county forests, totalling over 25,000 acres. Several hundred demonstration plantations have been made by towns, cities and townships. These comprise small plots of from five acres to a few hundred acres and are for various purposes—to protect city water-sheds and waste areas along highways, and frequently to stop drifting sand which is menacing the highway. Several hundred schools have made forest plots of one to ten acres in size. Two Boy Scout forests are being developed, and Scouts have to date planted almost 1½ million trees!

Such work is admirable, but it is only a beginning. There are still thousands of acres to be developed and improved. There is a great need for awakening of public conscience concerning forestry and all phases of conservation.

OPPOSITE PAGE. (Top and middle) These Ontario sand lands—mistakenly cleared for agriculture and now abandoned wastes—once contained good stands of white pine. Elevated roots indicate that three to four feet of soil has washed or blown away. (Bottom) Forest and farm are gone and only the barren limestone outcropping remains.

THIS PAGE. (Top) Nursery beds of white spruce, with seed beds in background. (Middle) Block of four million red pine transplants, with seed beds in background. (Bottom) Four-year-old plantation of jack pine, on sandy soil.

of tree sap is the answer. A tree is almost always a solid column of water or sap from roots to leaves. As water evaporates from the leaves, more water is pulled up into the leaves from the tree. Sap has great tensile strength—2,250 lb. per square inch—which is theoretically enough to lift it to the top of a tree almost a mile high.

The tree contains most water in the springtime before its foliage is full. In the dry summer spells, the water content falls off somewhat because there are so many leaves using water so prodigally. About 98% of the water taken up by the roots is passed off through the leaves as vapour. Only 2% of it goes back as food to build and nourish the tree. Evaporation from forested areas must be truly enormous.

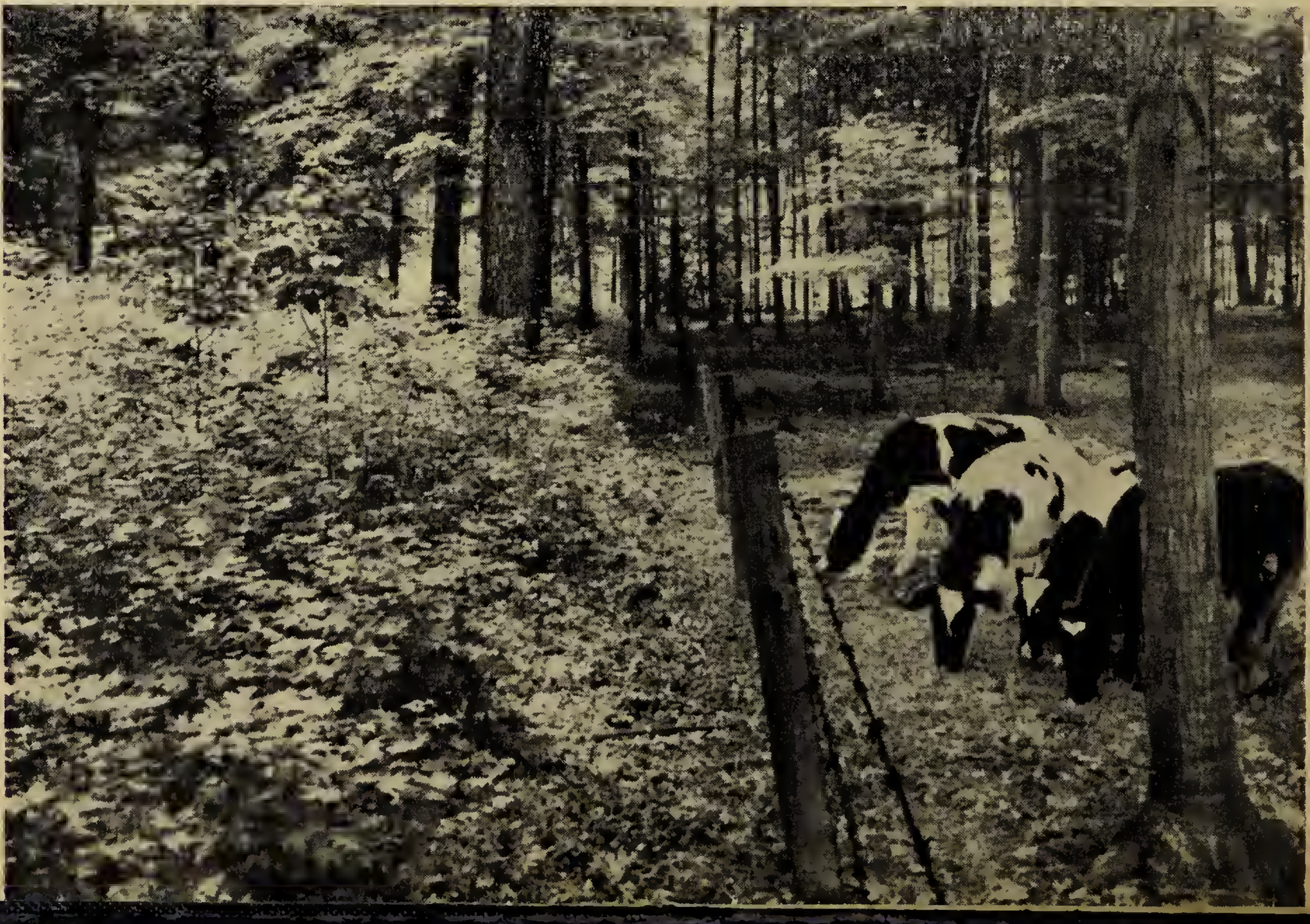
The Importance of Farm Woodlots

FARM woodlots are an important part of the country's forest stand. Although individually small, in the aggregate they total a vast area. To the farmer the wisely-controlled woodlot supplies fuel, posts, building material, maple syrup and sugar, and often serves as a shelter belt against the winter wind. Besides—and this is very important—it acts like other forested areas to trap moisture and to let it seep into the soil and contribute to the ground-water.

The best woodlots are those on which grow trees of all ages—seedlings, small trees and mature trees. Mature trees scattered through the stand are the ones which should usually be used for fuel or lumber.

To produce best results cattle should be kept out of the woodlot, since they destroy small trees and their constant trampling packs the soil so that trees do not grow well in it. A woodlot is doomed if there are no young trees growing up, and a grazed and trampled woodlot loses much of its power as a water-holding agent. If a shady spot is needed for livestock, a part of the woodlot should be fenced off for them.

Woodlots, like larger forest areas, should be harvested wisely to ensure the greatest long term benefit. In too many areas the portable sawmill has done a lot of damage in removing, particularly, young thrifty trees. The system of selling acre or half-acre blocks of timber for fuelwood is another vicious practice, for the reason that in nearly every case the purchaser clean-cuts every tree which can be used, down to an inch or two in diameter. Some system of regulating cutting of woodlots would correct this situation, and certainly areas which are connected in any way with the headwaters of streams, or the feeding of springs, should be controlled to the extent that they cannot be clean-cut.



Trees for Tomorrow

AMERICAN FOREST PRODUCTS INDUSTRIES, INC.

WHAT is a tree? A tree is defined as a hardy, long-lived plant having a single main stem or trunk, crowned by leafy boughs. It commonly exceeds ten feet in height.

Trees which industry calls "softwoods" are usually coniferous—that is, the naked seeds are borne in cones—usually evergreen, and have needle-like or scale-like leaves. The "hardwoods" have broad leaves, produce seeds with outer coverings, and for the most part are deciduous, shedding their leaves every autumn. However, there are exceptions within the general classifications. The larches are deciduous conifers. The junipers and yews, though classified as conifers, have berry-like fruit. Several hardwoods, though broad-leaved, are evergreen.

A tree is alive, and depends upon moisture and sun for reproduction. Like human beings trees require food; like us they need water to drink; like us they must have light. Deprive a tree of food, water, air, warmth or light, and it will die. Like us, too, trees are born, grow, reproduce, work, rest, and die of old age. Some trees live twenty years and some live for centuries, but all eventually die.

Modern forest management helps to make forests continuously useful by harvesting trees when they are ripe, by protecting them from their enemies and by assuring conditions under which new tree growth may continue.

Forest management is the same in principle as agriculture, although its processes are slower. Only one year is required to ripen a field of wheat. Trees take longer. You may ask, "Who wants to wait a hundred years, or fifty years, or even twenty-five, for a tree crop to grow?" If we cut our forests clean, or cut carelessly, destroying the young trees in our haste to harvest the big valuable trees, then we *shall* have to wait that long—about one crop in a lifetime. But the good forester does not do this. Our forests contain trees of all ages. The forest manager usually harvests only fully-grown trees which, were they left standing, would eventually die of old age. This system is called "selective cutting". Old trees, trees weakened by insects or disease, and those which are gnarled or bent, are also cut. Such trees are removed to make room for young healthy trees which will grow faster with more space and more sunlight. When these young trees are mature, they too will be harvested and seedlings will take their place.

In some woods the trees are all the same age. Good forestry may then require the cutting of almost the entire stand. In other forests where trees are all the same age, but still young, certain trees may be thinned out and used for pulpwood, mine props and fence posts. This process improves a forest just as thinning out or weeding improves a garden.

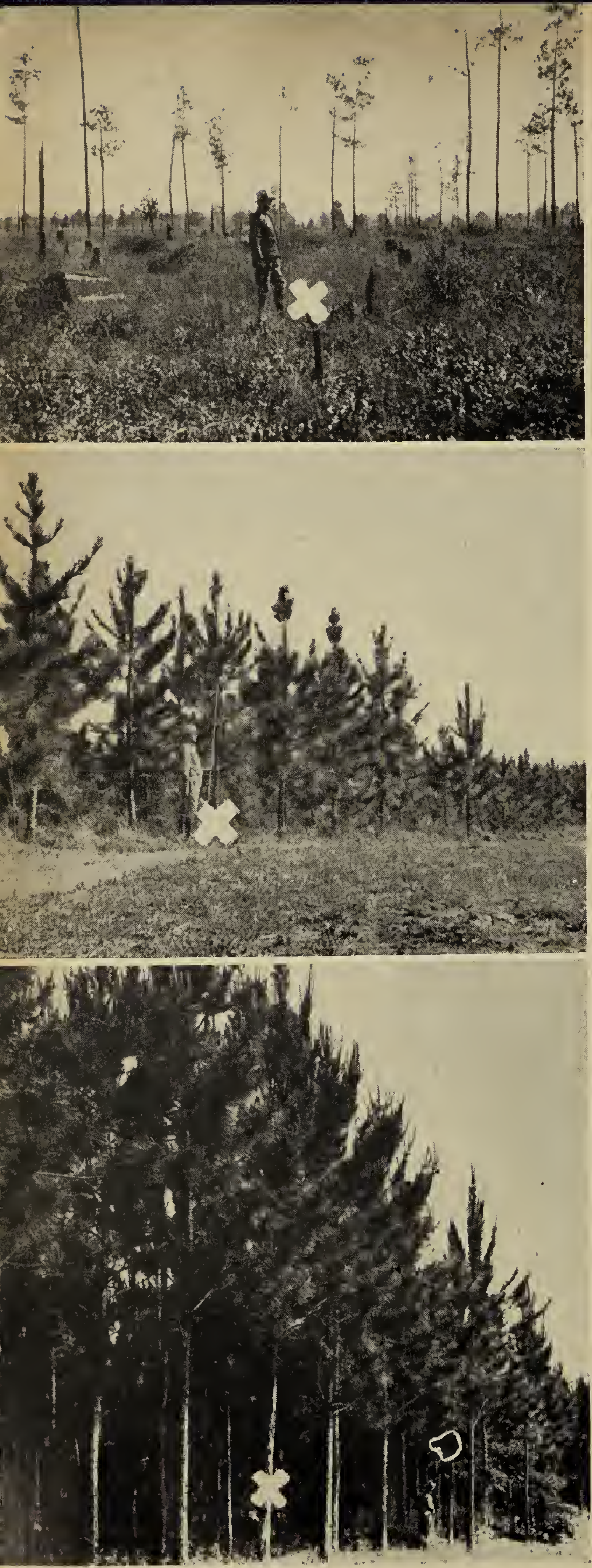
But even when most of the trees in a given area could be cut at once, not all are taken by the good forester. Choice seed trees, individually or in groups or blocks, are left to reseed the land. [Frequently these parent trees are left in stands on ridges of land that the wind may broadcast their seeds over the cleared land. This regrowth of the forest from the seeds of parent trees is called "natural regeneration", and is one advantage that the forester has over the farmer. Another great advantage is that while the ordinary farmer must continually enrich his soil with fertilizers, trees themselves restore fertility by dropping leaves and twigs which decay to form rich nourishing humus.]

NB:

Growing and harvesting trees is only part of our woodsman's job. He must be constantly on the alert against the forces which destroy his crops. During the ten years 1930-39, fires, insects and disease removed each year an average of 1.7 per cent of the commercially useful timber in the accessible forests of Canada—700 million cubic feet a year by insects and disease, and 400 million cubic feet by fire, much of it preventable.

Careless smokers—fellows who toss lighted cigarettes out of automobile windows or just drop them in the dry leaves in the woods—cause about 16% of the fires. Careless campers who fail to make sure their campfires are out before they leave, cause another 18%.

Government forest services are continually improving their methods of detecting and reporting forest fires through the use of look-



out towers and aircraft and through the provision of telephone and radio. In some areas roads in the forest and in others aircraft are used to rush fire fighters and their equipment to the scene of fires. But without the full cooperation of the public in preventing the starting of fires, loss from this preventable source will continue.

When fire does run wild and destroys young growth and stops natural regeneration, the good forester must help nature make a new start by planting seedlings which have begun their life in tree nurseries—either privately owned nurseries or the many forest stations which are maintained by provincial governments. Areas which have been clean-cut by unwise and greedy individuals or concerns, must also be reforested by hand-planting.

Trees often grow well on land which will not raise farm crops. Land worn out by poor farming methods may grow trees and be restored to fertility at the same time. Even land which has lost its topsoil by erosion will grow trees, and in time—a long, long time—its topsoil will be restored. Here is another way in which trees work for man.

Control of fire, unending warfare against enemy insects and disease, proper harvesting of new trees, and new planting where necessary, are the keystones for forest care. If these simple rules are followed our forests will grow greater and richer through the years instead of smaller and poorer. Is this effort worthwhile? We think you will agree that the answer is emphatically "Yes!"

AS THIS TRACT of harvested land shows, nature has a great urge to grow trees. (Top) Six inches high. (Middle) Five years old, 11 feet high. (Bottom) These 10-year-old pines averaged 30 feet high and many were large enough for pulpwood, poles and posts. Trees often grow well on land which will not raise farm crops. Even eroded land will grow trees, and in time its topsoil will be restored. Forest management makes forests continuously useful by harvesting trees when they are ripe, by protecting them from their enemies and by assuring conditions under which new growth may continue.

Wildlife Management

J. R. DYMOND

WILDLIFE conservation is of more importance in Canada than in many other countries because more than two-thirds of the area of our country will produce no other permanent crop. Less than ten per cent of the area of Canada is cleared land suitable for the production of agricultural crops, another twenty per cent is productive forest land capable of producing economic crops of timber and pulpwood. The balance, about 70 per cent of the total area, is unproductive forest land, muskeg, rock, etc. But these regions, together with our immense water areas, if properly managed, will yield permanent crops of game and fur-bearing animals and fish.

The term "wildlife" is often restricted to birds and mammals which are hunted as game, such as deer, moose, grouse, ducks, geese, etc., and the mammals which yield valuable furs, but actually wildlife includes all creatures living without the care and protection given to domestic animals. In this sense it includes birds of all kinds, mice, groundhogs, porcupines, snakes, frogs, turtles, insects, earthworms and even less conspicuous creatures. Without some of these the larger and more directly valuable animals could not live. All have their influence on the welfare of the more obvious ones, and all are of interest to the thoughtful student of nature.

Much of our wildlife has been badly managed in the past. Not so many years ago beaver had been allowed to become so scarce that governments had to prohibit the trapping of them in most parts of the country; the marten and fisher, two of our highest priced fur-bearers, are virtually extinct over vast areas and fears are felt for the continued survival of moose in many places where it was formerly abundant.

Slowly it is beginning to be realized that the wise management of wildlife is not as simple as many had thought. Actually, managing wildlife wisely is much more difficult than rearing domestic animals since fewer factors on which their welfare depends are understood or under control.

THE WILDLIFE COMMUNITY

An appreciation of the needs of wildlife can only be had from some understanding of the wildlife community. Just as the various people living in a community are dependent on one another, so the various kinds of plants and animals living in a wildlife community affect one another. By way of illustration, let us consider how some of the plants and animals of a self-contained community such as that on an island are related to one another. In the grass live grasshoppers and meadow mice; on the leaves of the trees and other plants live insects; when the trees die other insects live under their bark or bore into their wood; ants build their nests in the ground and feed on many kinds of small insects and on sweet secretions of plant lice; earthworms dig into their burrows and eat decaying leaves; birds of various kinds feed on insects, worms, or seeds of the trees, shrubs and other plants. If the community is large enough, hawks and owls will be able to support themselves by feeding on the grasshoppers, mice and small birds. Any mouse that dies or is killed and not eaten by larger animals is disposed of by burying beetles.

THE ROLE OF THE PREDATOR

One aspect of the wildlife community which is not generally understood is the role of the predator.

A short-sighted view might suggest that the community could get along quite well without the hawks and owls preying on the grasshoppers, mice and small birds. When, however, one reflects on the reproductive capacity of animals, it is realized that without some check on the growth of the population, mice, for instance, would soon be so numerous that they would seriously injure the vegetation. Many examples might be quoted of the disastrous results arising from the increase of plant-eating animals in the absence of the predators which normally keep their numbers in check. Predators play a necessary part in the wildlife community in keeping the population of plant-eating animals from be-

PART OF THE SCHEME OF NATURE. The pretty little white-footed mouse, or deer mouse (above), is commonly found in or near wooded sections in many parts of Canada.

(MIDDLE) Cooper's Hawk

(BELOW) Our good friend the honey bee.

coming so large as to destroy much of the plant cover.

In an area under natural conditions flesh-eating animals live on the *surplus* plant-eaters. All kinds of animals produce many more young than can possibly survive. It has been estimated that the progeny of a single pair of meadow mice, if none died, would at the end of one year amount to a million; from a pair of robins it would be possible to have fifty at the end of the second year; and a pair of deer and their progeny would total more than fifty in ten years if all survived and the females produced young when two years old. If some factor did not remove the surplus produced each year, populations would increase until the food supply failed or disease became epidemic and drastically reduced numbers. The worst feature of over-population is that before starvation or disease effect a reduction in population, the plant life of the area occupied is so over-eaten that it requires years to return to normal; in the meantime far fewer animals than originally lived on it can find food or homes there.

Protection of Hawks and Owls

Hawks and owls are among the most misunderstood of our predators. As a matter of fact, many of them play a most useful role in destroying mice, rats and other destructive rodents. The preferred food of some of our commoner species is as follows:

Goshawk, birds, hares; *sharp-shinned hawk,* birds; *Cooper's hawk,* birds, rats and mice; *red-tailed hawk,* meadow mice, deer mice, varying hares, birds; *red-shouldered hawk,* snakes, frogs, toads, meadow mice, birds; *broad-winged hawk,* meadow mice, grasshoppers and other large insects, toads, frogs; *rough-legged hawk,* meadow mice, house mice; *golden eagle,* small mammals and birds; *bald eagle,* dead fish; *marsh hawk,* meadow mice, cottontails, birds; *sparrow hawk,* grasshoppers and other insects, meadow mice, sparrows; *screech owl,* deer mice, meadow mice, insects, birds; *great horned owl,* hares and cottontails, squirrels, rats and mice, birds; *snowy owl,* rats and mice, occasionally birds; *barred owl,* meadow mice, rats, insects, frogs; *great gray owl,* meadow mice, deer mice; *long-eared owl,* meadow mice, deer mice; *short-eared owl,* meadow mice, birds.

In the case of those which eat birds, it should be remembered that they take the most abundant species in their vicinity. Examination of the stomach contents of twenty Cooper's hawks, a bird-eating species, killed on their fall migration through southern Ontario, showed that fifteen of them had eaten starlings, an introduced species which is now the commonest resident bird in this part of the province. Numerous observations of screech owls living in winter in cities have shown that their food consists largely of English sparrows.

Predators and Natural Selection

The predator, in addition to trimming down the population of plant-eating animals to the carrying capacity of an area, acts unconsciously as a selecting agency in deciding what individuals shall be allowed to reproduce. In the breeding of domestic animals man permits only those individuals to breed which measure up to a high standard of speed (for race horses), size and quality (in beef cattle), milk production (in dairy cattle) or egg production (in laying hens). Under nat-

BEAVER are the original and greatest conservationists. By systematic storing of water they keep creeks running all summer that would otherwise dry up soon after the spring freshets; a habitat is created for fish; and aquatic vegetation is provided for the advent of muskrats and waterfowl. As old beaver ponds fill they become rich meadows.

ural conditions the predator carries out a similar selective process by killing and eating a part of the population. Usually the weaker and less alert individuals are taken, the stronger and more cunning standing a better chance of surviving to reproduce and pass along their superior qualities to their descendants.

Since it is impossible to use man's methods of artificial selection in wildlife management, natural selection must be permitted to take place. The predator is a necessary part of natural selection.

Carrying Capacity

There is a rather definite number of each species of wildlife which can live in a given area. This may be illustrated by reference to the ruffled grouse. In the spring each pair of grouse lays claim to a section of woodland within which they live and bring up their family during the following summer. Such an area is known as a territory. Within it, the male drums, the eggs are laid, and the young hatched and reared. The family does not wander at large, but throughout the summer is confined to its own territory. Not every type of woodland will serve as a grouse territory. It has been found that pure stands of conifers are not occupied; a grouse territory must contain some broad-leaved trees. It must contain some underbrush or a tangle of smaller growth. There must be some open space which is usually used as a dusting and sunning ground. Grouse territories containing these essential elements must be of such a size as to provide adequate food for the growing family throughout the season.

In any stretch of woodland there is only a limited number of suitable grouse territories. When all are occupied it is impossible to increase the population permanently beyond that number of families. If more grouse were introduced into a fully occupied region, the newcomers would either be unable to find homes or, if they did, they would displace others, which would either starve or be so exposed to predator attack that they would ultimately disappear.

Food

Food is of first importance in determining how many animals can live in a given area.

Sometimes it is the amount of food available in winter which determines the population of an animal which an area will support. Most areas where deer live provide adequate summer food; it is in winter that deer feel the pinch of hunger. White cedar is the staple food of deer in winter throughout much of their range and the size of the deer population is determined by the amount of cedar available to them in winter. No animal can live in numbers greater than can find food and it is unwise to permit a species to become too abundant for its food supply, if it can be avoided.

Cover

Every animal needs a home, a place where it feels reasonably safe from enemies and where it is protected from the elements, excessive heat in summer and cold in winter. No animal will live where it cannot find conditions which provide such a place of retreat. Stands of large forest trees do not provide adequate cover for deer since such stands are quite open. An area where young growth has attained a height of about twenty feet provides much better cover, as it does food also. The fact that grouse do not live in pastured woodlots, but insist on a tangle of undergrowth in some part of their territory, indicates their need for cover. Cottontails and other wildlife are usually more abundant where hedgerows provide cover. Beaver, muskrats, chipmunks and mice make their own cover, if conditions are suitable, in the form of houses or nests.

Cover protects animals against excessive destruction by predators. Plant-eating species are not as helpless aginst their natural enemies as is often supposed. Predators have their difficulty in finding and overcoming their prey, especially where the latter is provided with cover. Under conditions natural to a species it always has and always will be able to survive in numbers. Maintenance or provision of adequate cover is one of the essential needs in wildlife management.

What constitutes adequate food and cover is not known in the case of many species of wildlife. The lack of knowledge of the needs of wildlife is illustrated by the moose situation in Canada. Why moose disappear from one area and appear in another after being present or absent for long periods, is unknown. Information is not available which would enable us to manage an area so as to ensure its success as a moose reserve.

Wildlife research is one of the most pressing needs to ensure the success of wildlife management.

WINDBREAK planted 14 years ago has facilitated the control of wind erosion. Windbreaks afford protective cover in areas where shelter and nesting sites for birds are noticeably scarce. Trees are also very effective in causing snows to drift, thereby preserving precious moisture.

A BORDER OF SHRUBS increases the value of woodland "edge" for wildlife, prevents drying resulting from wind sweep and eliminates shade and root competition with field crops.

POPULATION OF ANIMALS

The above discussion of carrying capacities suggests that for each species of wildlife there is a density of population for each area which cannot be safely exceeded. If for any reason more than the right number finds itself in an area, either some will be unable to find homes and as a consequence the surplus will be removed by predators, or if predators are not sufficiently numerous to remove the surplus, the excessive number will injure the habitat and ultimately many will die of starvation or disease.

Not enough wildlife studies have yet been made to yield reliable information as to the number of different kinds of animals which can live in different types of country. Obviously, the number will vary with the type of animal; many more mice than deer can live in the average stretch of woodland. Also, the number of the same kind of animal, for example grouse or bob-white, will vary in one place as compared with another.

In Algonquin Park, Ontario, where beaver have long been protected and may be considered to have reached an equilibrium with their environment, it has been found that there are on the average three occupied beaver houses in four square miles. The number varies from ten on well-watered areas containing plenty of suitable food, to none on areas lacking water.

THE BALANCE OF NATURE

The discussion thus far has brought out the fact that animals and plants under natural conditions live together in a wildlife community and that the various elements of the community exist in a sort of balance. If, for instance, there is not the proper balance between plant-eating and flesh-eating animals, so that the population of the plant-eaters increases year after year, there ultimately comes a time when there is no longer enough food for them and their numbers fall to a point at which the food will support them. As the number of plant-eaters declines, the number of the predators will also decline, since flesh-eaters are as dependent on their food supply as are plant-eaters. As the food plants gradually recover from the effects of the over-population of plant-eaters, the population of the latter will gradually increase as will also that of their predators. The balance of nature is not a fixed balance but a swaying one. The number of plant-eaters affects and is affected by the abundance of their food and in turn affects and is affected by the number of flesh-eaters. The same is true of disease organisms since they are in a sense tiny flesh-eaters. Crowding of animals favours the spread of disease which in turn reduces numbers to the point where disease is no longer common.

The various elements in a wildlife community—plants, plant-eaters, flesh-eaters and disease organisms, fit together in a pattern which may be compared to the pattern made by the fitting together of tiles in a mosaic. The pattern of each wildlife community has been worked out by nature through many thousands of years, and it is the business of the wildlife manager to understand it and to work in accordance with its principles. To violate its laws is to bring disaster to it.

PRESERVING AND RESTORING HABITATS

The two most important phases of wildlife management are the maintenance of suitable habitats and the regulation of hunting or trapping in line with the carrying capacity of the area being managed.

By habitat is meant the kind of place in which an animal lives. To ensure that an animal will live in numbers in an area it is necessary to maintain food and cover conditions suitable for that animal. If conditions have been destroyed or injured it is necessary to restore them. An illustration of the increase in population following restoration of suitable habitat conditions is afforded by the restoration of the marshes on the delta of the Saskatchewan River in northern Manitoba. On one 160,000 acre area in this region the number of muskrat houses increased from 65 to 11,400 in three years following flooding of the area and holding the water at suitable levels as a result of the construction of dykes and dams.

HARVESTING THE WILDLIFE CROP

In managing a wildlife area for game and fur the population should be permitted to increase up to its carrying capacity and then only the natural increase removed each year. If more than the natural increase is taken, the breeding stock will gradually decrease until the area is producing far fewer animals than it is capable of doing.

Some wildlife areas in Canada are yielding a far smaller harvest of game and fur because they no longer provide suitable habitats for

THE MANITOBA GOVERNMENT has done a splendid job of water control and wildlife management on some half million acres of the Saskatchewan River delta marshes near The Pas, Man. From practically nothing, the revenue from muskrats has been built up to an annual amount in excess of $500,000.

CANADA GEESE—a happy family group in their natural habitat.

(Top) Feeding at break of day. (Bottom) In the silence of the wilderness.

the desired animals; others produce a scant crop because over-hunting and over-trapping have reduced the breeding population of game and fur-bearing animals far below what the areas are capable of supporting. The increased production that is possible through permitting the breeding stock to increase is illustrated by several experiences in the management of beaver reserves. In one reserve the population increased from 80 to 13,000 in twelve years. It is surely a great economic waste to reduce our wildlife stock to the point where it will provide less than one per cent of what is possible.

The Aesthetic Value of Wildlife

Wildlife has values other than the economic return from game and fur. While bird life helps to keep down insect pests and to destroy weed seeds, it also has great aesthetic value. The observation and study of birds adds immensely to the pleasure of many thousands of our people and with proper education could contribute to the joy of thousands more. There are many who prefer to observe and photograph deer, moose and other game and fur-bearing animals than to hunt them for sport or gain. Everything in nature holds an interest for those who have eyes to see, ears to hear and minds to understand the beauty and pattern of the wildlife community.

The Preservation of Beauty

In considering the aesthetic value of wildlife, a special plea is perhaps needed on behalf of the preservation of wildflowers. These suffer from the same two factors as the other elements of the wildlife community—destruction of habitat and over-picking.

Much of the destruction of the woods in which many of our attractive wildflowers grow is inevitable, but some of it is not. Wherever wildflower habitats can be preserved, especially in the vicinity of the larger centres of population, they should be guarded for the joy the flowers give to so many. Over-picking should also be restrained. A few people can rob thousands of the pleasure afforded by a sight of wildflowers, by picking and carrying them away for their own personal pleasure. In city parks and near our cities and towns wildflowers should be allowed to blossom for the many rather than be picked for the satisfaction of a few. The destruction of wild flowers is more often a result of ignorance than of vicious intent, and could be decreased if more people realized the consequences of over-picking. Let's explain these facts to the uninformed.

Fresh and Salt Water Fish

J. R. DYMOND

Few countries have more extensive or richer salt-water fishing grounds adjacent to their coasts and none have as much fresh-water as Canada. In the variety and quality of its commercial and game fishes Canada is supremely fortunate.

Among the more important commercial fish of Canada, in order of value, are: salmon, cod, herring, lobsters, whitefish, halibut, pilchards, haddock, mackerel and pike-perch.

Atlantic Coast Fisheries

Marine fisheries are of two sorts—bank or off-shore, and in-shore or coastal. Off our east coast all of the more important fishing banks of the western Atlantic are within 50 to 150 miles of the coast of Nova Scotia. These banks, of which the Grand Banks off the coast of Newfoundland are the most famous, are portions of the sea where the water is much shallower than elsewhere. The cod fisheries of these banks early attracted Europeans to this side of the Atlantic. John Cabot's report on his return to England in 1497 concerning the shoals of cod which he declared to be so numerous that "they sumtymes stayed his ships" and that the sea was so covered with fish that they could be caught with baskets, resulted in all the countries of western Europe sending fishermen to the new fishing grounds. Cape Breton, one of the earliest place names in America, is a memorial of the early French fishermen—and the Spaniards, Portuguese and Norsemen were little behind. These rich fishing grounds

have been exploited with abundant success down to the present. Fishing on these off-shore banks is known as deep-sea fishing in contrast to in-shore fishing nearer the coasts.

Cod is the most abundant of the fish on the off-shore banks, but haddock, hake, pollock and halibut are also taken. The in-shore fisheries are carried on within 1 to 10 miles from the coast. Here is where the herring, salmon, mackerel, smelts, shad and flat fishes (flounder, sole, etc.) as well as lobsters, oysters, clams, scallops and other shellfish are taken. Ten times as many fishermen are engaged in the in-shore fisheries as in deep-sea fishing.

PACIFIC COAST FISHERIES

Canada's Pacific coast fisheries yield almost as great a harvest as the east coast. Especially valuable are the salmon fisheries, among the richest in the world, which have usually been responsible for thirty per cent or more of Canada's total fish production. Sockeye, coho, pink and chum are the species usually canned, the first two bringing the highest prices. The spring salmon is usually sold in the fresh or frozen condition. Other important west coast fisheries are those for herring, halibut, pilchard and dogfish.

FRESH-WATER COMMERCIAL FISHERIES

Canada has more lakes than any other country. In addition to the Canadian portion of the Great Lakes, we have such large inland lakes as Great Bear, Great Slave, Winnipeg, Athabasca, Reindeer, Atlin, and Winnipegosis, all over two thousand square miles in area. The most valuable commercial fresh-water fish is the whitefish, which usually ranks fourth or fifth among all the commercial fish of Canada. Other important inland fisheries are those for pike-perch (yellow and blue pickerel), lake trout, saugers, lake herrings, pike and perch.

GAME FISHERIES

Besides commercial fish which are caught and sold as food, Canada possesses many of

(TOP) WITH WORD of the salmon run, hundreds of fishing boats head for the fishing grounds. Here a small fleet is towed to the area by a tug in British Columbia. (Centre) Spring and sockeye salmon are the livelihood of both white and Indian fishermen. The fish are loaded from the fishing boats into a scow which is towed to the canneries. (Bottom) Vital are the nets which are carefully dried and repaired after each trip.

the world's finest game fish, including Atlantic salmon, tyee (spring) salmon, rainbow trout, speckled trout, maskinonge and black bass. In addition, some which are taken commercially in the larger lakes are regarded as game fish in the smaller lakes and rivers, including lake trout, pike-perch (also called yellow pickerel and wall-eyed pike), pike, perch and grayling. The latter is a sub-Arctic species related to the trouts and found abundantly in many of the northern waters of the western provinces, the Northwest Territories and the Yukon.

Canada has two great advantages in the matter of sport fishing. The first arises from the great extent of our fresh water. Although these waters are not as productive acre for acre as many waters farther south, their prodigious area supports great numbers of fine game fish.

Our game fisheries are of the highest quality as well as quantity. Cold waters such as are found throughout Canada are the homes of the gamiest fish. Moreover, the forests, the mountains and the wild rocky country in which so many of our lakes and rivers are found, add greatly to the attractiveness of Canada's game fishing resources. As an important tourist attraction, their economic significance is considerable. Their value in providing healthful recreation for our people can hardly be overestimated.

CONSERVATION

The same principles underlie the success of aquatic life as apply on land. In the wise management of our fishery resources care must be taken to see that habitat conditions suitable to the requirements of the various species are maintained and that sufficient breeding stock is left to provide adequate reproduction.

The smaller the body of water, the easier it is to change its character so as to make it unsuitable as a home for fish. Natural conditions in streams, ponds and small lakes are obviously much more readily destroyed than

(TOP) FISHING is a major industry on the Atlantic seaboard. Here cod are laid out to dry. In recent years automatic dryers have supplanted the outdoor method. (Centre) As the fishing vessels return with their harvest, members of the crew clean and prepare the fish for drying. Here a load, all ready for the drying racks, is unloaded on a pier. (Bottom) Inspection and maintenance of the nets is the fisherman's insurance of a living.

are conditions in the sea. It is for that reason that many of our inland fisheries, especially the game fisheries of our streams and lakes, have suffered far more than the sea fisheries. There are many changes, any one of which may destroy a body of water as a suitable habitat or home for a particular species.

Each kind of fish can thrive only within a limited range of temperature; many of our streams have become too warm for trout. It should be remembered that it is necessary for the temperature to rise to unfavourable levels for only one day or part of one day each year, in order to kill or drive out certain desirable species of fish.

Shelter is just as necessary to fish as it is to deer or quail. Trout will not stay in a stream or part of a stream which does not provide them with shelter from the prying eyes of their enemies, and only so many fish will stay in a section of stream as can find homes, which includes shelter.

Pollution has destroyed the fish-carrying capacities of some waters. Research is needed to determine the effects on fish life, and how to overcome them, of wastes from pulp and paper mills, mines, gas plants, creameries, and manufacturing plants of various kinds.

Overfishing

Just as each tract of land will provide homes for only so many birds or mammals, so each body of water will support only a limited number of fish. The productive capacity of many of our waters is lower than is often supposed. This is especially true in rocky regions from whose surfaces comparatively little in the way of nutrients is carried into the waters from the surrounding land surfaces. Fish life is ultimately dependent on the same fertilizing elements as make soil rich. To take so many fish from a body of water that too few are left to produce an adequate crop of young is to lower the yield beyond what a body of water is capable of producing.

Fertilization of Waters

Since so much of Canada's fresh water lies on the Canadian Shield and in other rocky regions, its fertility is lower than of regions having richer soil. However, what these waters lack in fertility is partly compensated by the high quality of the fish they produce—whitefish, trout and their relatives. Considerable interest has been aroused by the success of fertilizing ponds in certain parts of the United States, and the question is raised as to why such success cannot be duplicated in Canada. It must be remembered in this connection that there is a great difference between the warm-water species—largely bass of various species which thrive in southern waters—and the cold-water species, especially trout, of our northern waters.

Research is necessary before we can learn to fertilize our northern cold trout waters so as to increase their productive capacities. Since these are so poor in nutrients to begin with, there may well be a limit to the size of waters which it may be economically feasible to fertilize.

Planting Hatchery Fish

Canada long ago began planting hatchery-raised fish in efforts to replenish waters in which fish were fewer than were thought desirable. In many of the waters so stocked, little or no improvement has resulted, probably owing to the fact that the waters were originally or have become, unsuitable for the kinds introduced. In other cases, the productive capacity of the waters is not sufficient to support more than the number produced by natural spawning of adults already present.

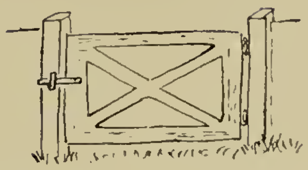
Another cause of the failure of planting hatchery fish to increase or maintain fishing, is that the numbers introduced, although actually large, are relatively so small as to make an insignificant contribution to natural reproduction. This is especially true in the ocean and in large inland lakes where the few million fry that can be economically produced in hatcheries adds little to the billions produced naturally.

There are, of course, conditions under which hatcheries can assist in maintaining or increasing fish production, but the number of such conditions is far fewer than is generally supposed.

If it had never been discovered that we could hatch fish eggs artificially, the conservation of our fishing resources might well have been further developed than it is today, for we would probably long ago have learned to depend on the maintenance of proper habitat conditions and to adjust the take to the carrying capacity of each body of water. These two principles are the cornerstones of all successful wildlife management, whether of game, fur or fish.

OUTDOOR BEHAVIOR

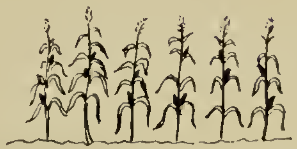
Leave the fields and woods as you find them — unless you make improvements.



1. LEAVE GATES AS YOU FIND THEM.

2. HONOR THIS SIGN.

3. STONE WALLS ARE HARD TO BUILD. DON'T KNOCK THEM DOWN, OR TAKE STONES AWAY.



4. WALK AROUND PLANTED FIELDS – NEVER THROUGH THEM.

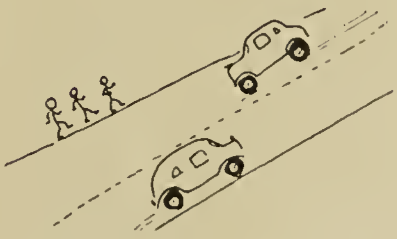
5. DON'T CUT INTO OR TAKE BARK FROM A LIVING TREE.

7. BE SURE YOUR FIRE IS OUT.

6. BURN RUBBISH – OR PUT IN CONTAINER – OR TAKE IT HOME WITH YOU.

In the City or On the Highway

8. KEEP HANDS AND FEET INSIDE BUSSES AND CARS.



9. STOP TOGETHER AT TRAFFIC LIGHTS.

10. WALK SINGLY OR BY TWOS – FACING TRAFFIC.

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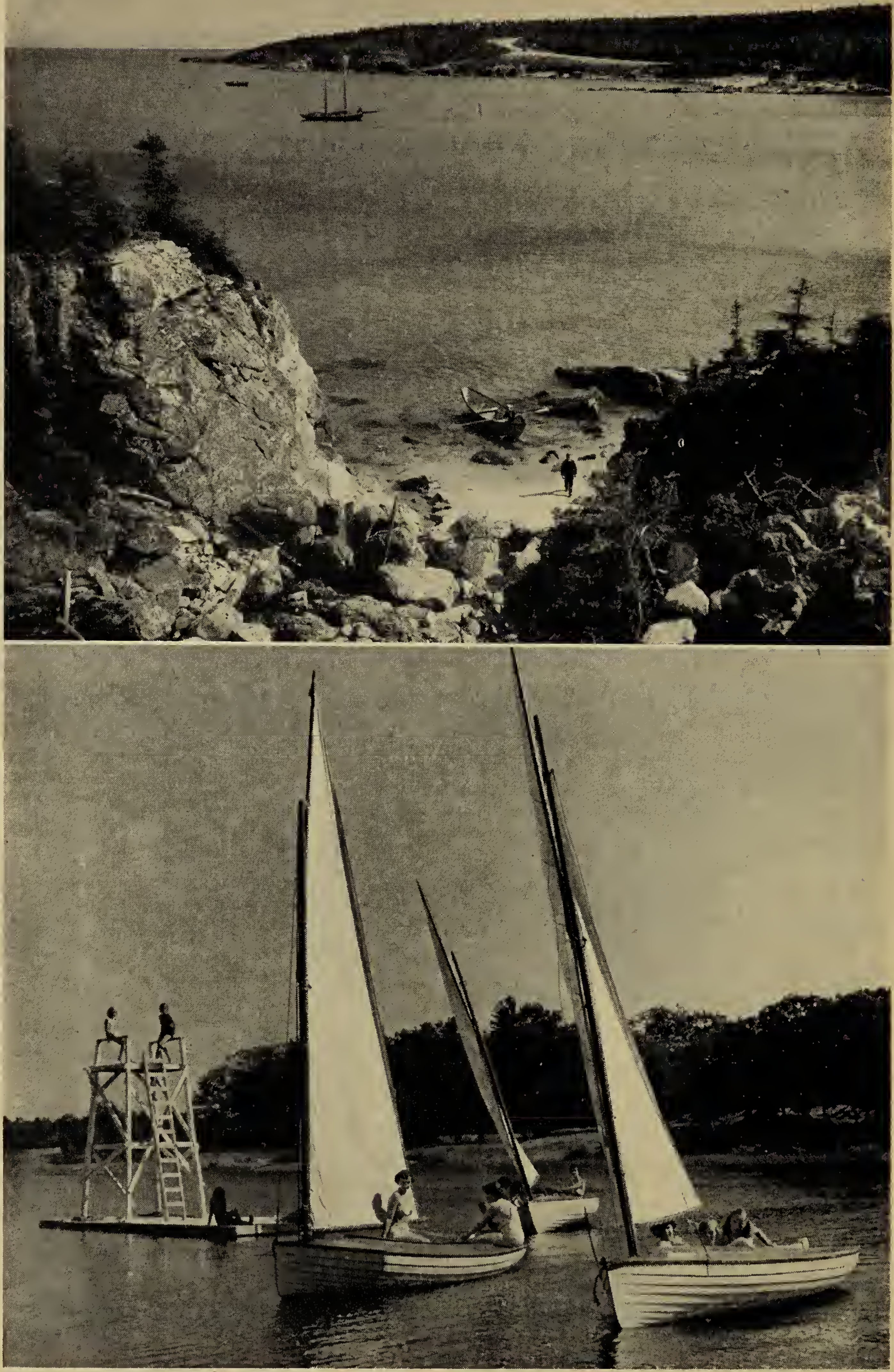


(Top) Cape Breton Highlands National Park (Bottom) Georgian Bay National Park

National Parks of Canada

L. B. CONNERY

NEARLY 2,000,000 visitors came to Canada's national parks in 1950, and the wildlife which enjoys protection in these federal sanctuaries was no mean factor in attracting them.

From a modest beginning of 10 square miles, set aside around the hot springs at Banff, Alberta, in 1885, the parks operated by the Canadian Government have grown to 26 separate units. Banff National Park, for instance, now covers 2,564 square miles and contains some of the most spectacular scenery to be found in the Canadian Rockies. Its holiday resorts, Banff and Lake Louise, are known the world over.

By automobile, horseback, canoe or afoot the tourists come. Hundreds of miles of excellent roads have been built, riding and hiking trails reach out into the wilderness, and the many lakes and rivers offer almost unlimited scope for fishermen and canoeists.

All of Canada's national parks are wildlife sanctuaries, containing almost every species of big game native to Canada. Firearms are taboo and no traps may be set within the parks. Visitors must do their hunting with cameras only.

Buffalo, wapiti or elk, deer, moose, Rocky Mountain sheep and goats, and bear all seek haven in these outdoor wild life museums. Some species, such as buffalo and antelope, were nearly extinct until establishment of the parks. They might well have disappeared without this form of protection.

The parks were not established with the tourist business in mind, for at their beginning there was no general tourist movement as we understand it today. They were designed largely for conservation, and still play a most important role of that kind. They were used to conserve nature in its original forms, to preserve forests and water resources for the benefit of the surrounding country as well as the parks themselves, and to preserve the animal and bird life native to their areas.

When animals learn that man will not harm them, they become astonishingly tame. So it is that in the national parks of Canada young visitors may admire fawns while the parent doe looks on, and the rest of the wild community shows a frank and friendly interest in the human callers. Their freedom from pursuit and violence has resulted in deer, elk and moose approaching to within a few yards of tourist accommodation in the parks, and on the mountain highways Bighorn sheep allow visitors within camera range. The parks are thus becoming reserves for big game, and the overflow, spreading beyond their borders, is restocking the surrounding districts in which wildlife would otherwise be lacking.

Elk Island National Park in Alberta has, since the closing of Buffalo Park at Wainwright, become the home of the plains buffalo. More than a thousand fine, healthy animals roam this 75-square-mile enclosure of lush pastures, fresh lakes and many shade trees. Other big game species in this park include elk and a smaller number of mule deer and moose.

Wood Buffalo Park, lying partly in Alberta and partly in the North-West Territories, has herds of wood buffalo. This park covers more than 17,500 square miles and because of its size and extensive forests it is difficult to estimate the size of its herds. Observers have placed the total at about 9,000 head.

Some of Canada's mountain playgrounds —Banff, Jasper, Kootenay, Yoho, Glacier and Waterton Lakes National Parks—have big game aplenty. Rocky Mountain sheep and goats are perhaps the most common species. The sheep are not nearly so shy as the goats, which rarely give camera fans a chance to get within reasonable shutter distance.

Excellent fishing is enjoyed in Canada's national parks, and constant re-stocking of lakes and streams with game fish adds each year to the chances for good angling. Among the best known varieties to be found in the western parks are such trout as the cutthroat, rainbow, Kamloops, Dolly Varden, eastern brook and great lakes. Salmon, bass, pike and muskellunge are plentiful in the eastern parks.

Besides the scenic and sanctuary parks, a number of national historic parks have been set aside in Canada to preserve places of outstanding interest in the country's history.

Ancient buildings and monuments have been restored to recall a colourful past. Port Royal, Fort Anne and the Fortress of Louisburg in Nova Scotia, Fort Beausejour in New Brunswick, Forts Chambly and Lennox in Quebec, and Forts Wellington and Malden in Ontario are all fine examples. Fort Prince of Wales at Churchill, Manitoba, is Canada's most northerly fortress.

Newest of the national parks is Fundy, in New Brunswick, which opened in July, 1950. Nearly 80 species of birds have already been identified there, and the wild animals most commonly seen include deer, moose, red fox, wildcat, beaver, raccoon, black bear, weasel, mink and rabbit.

Despite the absence of alarm which is apparent among the animals in the parks, visitors are advised to act with care, particularly with bears. However tame they may seem to be, there is always a risk in being overly familiar with creatures of the wild, particularly those that have been hunted down the centuries and may retain an instinctive fear of man.

During World War II young Canadians had an opportunity to serve as junior park wardens in the national parks system. A number of lads under 16, mostly of the Boy Scouts Association, were enrolled to assist the regular parks warden in such work as preventing and detecting forest fires, protecting game and other wild life and giving information to tourists. Some of the older boys accompanied senior park wardens on patrols and took part in week-end hikes. They were given lectures on wild life management, forest and game protection, trail riding, packing, camping, and the operation of radio and fire-fighting equipment. They also learned the geography of the park areas.

Junior park wardens were first and foremost conservationists. They learned to identify trees and flowers, animals and birds, and they studied the habits of the wild creatures in their natural surroundings. Their experience was beneficial to them and their country alike.

There was plenty for them to learn, for the national parks system in Canada covers 29,000 square miles and its units reach from Nova Scotia to British Columbia. In Nova Scotia there is Cape Breton Highlands National Park, in Prince Edward Island a national park bearing the name of the province, and in New Brunswick there is Fundy. Ontario has St. Lawrence Islands, Point Pelee and Georgian Bay Islands National Parks. In Manitoba is Riding Mountain National Park, and Saskatchewan has Prince Albert National Park. Probably the best known of all are Banff and Jasper National Parks in Alberta, which has Waterton Lakes National Park also. British Columbia has Yoho, Glacier, Mount Revelstoke and Kootenay National Parks. Western Canada's two wild animal parks are Elk Island and Wood Buffalo. There are also the national historic parks, listed before.

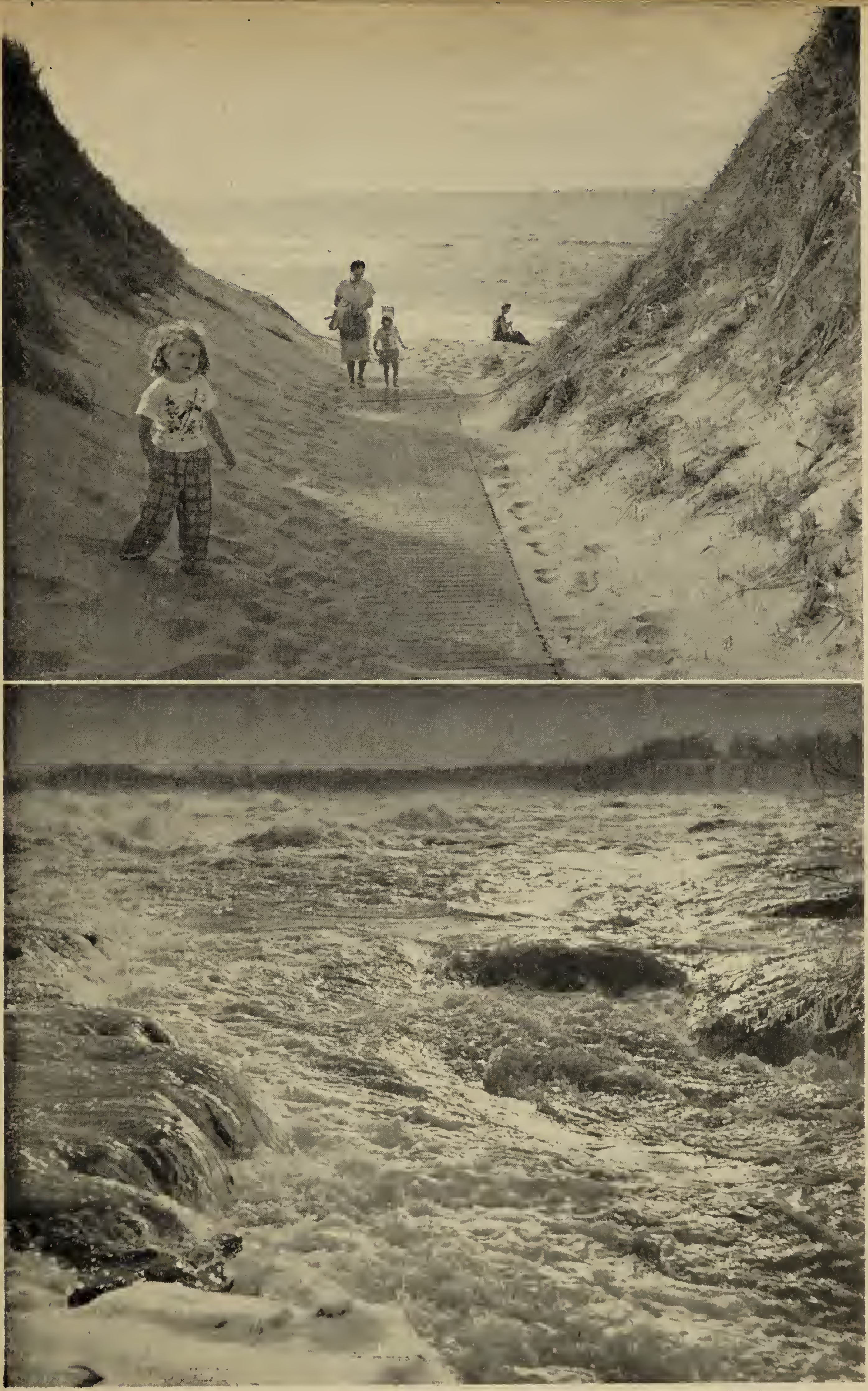
Biggest scenic park in Canada, and one of the world's largest, is Jasper, which covers 4,200 square miles. Its story is a fascinating chapter in the early history of Western Canada, for along the famous Athabasca Trail, through its green valleys and along its rugged mountain passes came the explorers, fur traders, missionaries, prospectors, engineers, botanists, geographers and a host of other pioneers of a bygone era.

The Jasper Park region is one of magnificent scenery. Amid a sea of mountains, many of them thrusting snowy peaks high above the clouds, are valleys studded with sparkling lakes and rushing streams. Within the southern area of the park and extending into Banff National Park lies part of the vast Columbia Ice Field, more than 100 square miles in size, a remnant of the Ice Age. From this ice cap and its glaciers spring rivers whose waters empty into three oceans, the Pacific, Atlantic and Arctic.

Jasper is one of the greatest wild life sanctuaries in North America. It has Rocky Mountain Sheep and goats, elk, mule deer, moose, mountain caribou, and black, brown and grizzly bears, as well as cougars or mountain lions, coyotes and wolves. Fur-bearing animals such as beavers, martens, otters, mink and snowshoe rabbits are plentiful, as well as several species of squirrel and chipmunk.

Bird life is abundant in Jasper too. There are white-tailed and willow ptarmigans, blue grouse, eagles, owls and ospreys, as well as many kinds of song birds.

Hardy lodgepole pines are the most plentiful trees in Jasper, and spruce, aspen poplar and balsam poplar are common too. Douglas fir grows in the vicinity, and on the upper slopes is Engelmann spruce. Wild flowers grow there in profusion, including colum-



(Top) Prince Edward Island National Park (Bottom) Surf, coast of Newfoundland bine, white dryas, Indian paint brush, yellow adder's tongue, fireweed, Alpine arnica, harebell, Alpine anemone, larkspur, heliotrope and mountain heather.

Since a fire in a national park can cause damage that cannot be repaired in a hundred years, visitors to Jasper, as to any of the parks, are soon made aware that fire prevention must never be forgotten.

Jasper, though larger than most of Canada's national parks, is typical of these great playgrounds that span the continent, stretch north to Hudson Bay and reach latitudes as southern as those of California. They are the finest examples of natural scenery which Canada can offer, and a most important factor in both wild life and forest conservation.

Let's Work for Conservation

ACT NOW TO INTEREST FRIENDS AND SCHOOLS

THIS Chapter is a call to ACTION! On the foregoing pages of this book we have presented basic facts and principles of conservation. We have proclaimed the urgent necessity for immediate and continued action to restore and maintain our rich heritage of natural resources. No one who has read thoroughly the preceding articles can fail to be stirred by the truth, logic and economic soundness of the case for conservation.

Now—what are we going to *do* about it? To read, to feel brief indignation, and then to go on living as before?—Then this book may just as well never have been published. But if everyone who reads these pages becomes an active conservationist, no matter in how small a degree, then we have accomplished what we set out to do.

INDIVIDUAL ACTION

Everyone can do something for conservation. We can all read and study conservation literature and form opinions on conditions in our own communities. We can lend our support to movements and individuals who are furthering the wise use of our natural resources. We can talk of conservation to our friends and neighbours. We can urge others to buy and read this book. We can find out what our local, Provincial and Dominion governments are doing about conservation; if we are not satisfied with what is being done we can write to our local representatives making specific suggestions for needed conservation measures in our own communities. We can write to our local newspapers. We can refrain from destructiveness and wastefulness of all kinds. We can adopt a humane and understanding attitude towards all wildlife and encourage others to do the same. All these things, and many others, can conservation-minded people do.

Those who are in control of basic industries can do a great deal more. They can study their own farms, sawmills, fisheries, mines, factories, as related to natural resources, and operate on conservation lines.

Let us all bear in mind that man cannot *own* nature; he can only act as a steward for his short life-time. Therefore it is up to him so to use and maintain his stewardship that it may be handed on from one generation to the next in as good, or better, condition than he received it. Gone must be the days of thoughtless exploitation for the largest immediate individual profit. In its place we must study and survey our resources and plan their use scientifically for the greatest benefit to the greatest number of people in this and succeeding generations. This is true patriotism—love of our country and of the people who dwell in it, translated into planning and action.

GROUP ACTION

Many things can be accomplished by a group which could not be accomplished by those same people working individually. A group has a louder voice and more influence, can pool its resources, share responsibilities. Therefore we urge group work for conservation wherever possible. This may take two forms:

(a) Conservation work may be undertaken as part of the programme of an already existing group or club, and a committee set up which will be responsible for a number of conservation activities during the year.

Emerald Lake with President Peak and Glacier. Yoho National Park, British Columbia

On one of the bridle paths. Riding Mountain National Park, Manitoba

(b) Better, Conservation Clubs may be formed with the express purpose of studying ways and means of improving local conditions and undertaking specific projects. We say "studying" advisedly, for conservation in whatever field is a subject which requires considerable knowledge and thought. Impulsive action based on sentiment or shallow thinking alone, can do more harm than good. Conservationists must *work,* continually adding to their store of knowledge and applying it in a fearless and logical way to their own communities.

Organization: There is no one plan of organization for a Conservation Club. This will depend upon local conditions and on the wishes of the membership. To keep the general aim and purpose of the group in mind it is well to formulate a statement of principles and perhaps draw up a formal constitution. The usual officers include a president, vice-president, secretary and treasurer. Whenever possible it is desirable to have committees comprised of members who are especially interested, to deal with different phases of the work.

There is a place for a Conservation Club in every community—rural or urban. A rural club would be most concerned with soil, forests, wildlife and water supply, and would probably consist chiefly of farmers. In organizing such a club let us forget county lines and township divisions. The logical area for a rural Conservation Club to cover is determined by geographical rather than man-made boundaries. To preserve soil and water supply, it is most important that as many people as possible in a given drainage area, such as a river valley, be persuaded to co-operate. Conditions on one farm are often very much affected by conditions on the next farm, or even on farms many miles away which cover the sources of the river which drains the area. Thus it is reasonable for farmers who share the same drainage area to work together, despite artificial boundaries.

As we have already emphasized, the first duty of any Conservation Club is self-education. This may be achieved by reading and discussion groups, listening to qualified speakers such as the county agricultural agent, local government forester, or someone from the nearest agricultural college, nature club, fish and game association, etc. The Audubon Society offers its services as an educational medium and every member of a Conservation Club should own and study a copy of this book which has been prepared specifically for Canadians and contains a wealth of sound information.

As soon as sufficient members have obtained a good general understanding of conservation principles, a survey should be made of the area served by the club, its forest, soil, water and wildlife resources assessed in the light of that knowledge, and suggestions made for improvement of conditions. If possible, separate committees for specific tasks should be appointed, to simplify the work of each member and at the same time to accomplish more work as a group. When conditions can be remedied by local action, such as tree-planting, contour ploughing, damming of gullies, restoring marshes, providing adequate wildlife cover, protection of predators, it should be undertaken co-operatively by the group. Departments of Agriculture and Forestry are pleased to cooperate with such restoration work by supplying free seeds, young trees, and advice. Adverse conditions which are beyond the control of the group, such as stream pollution or excessive commercial lumbering operations, should be brought to the attention of the parties responsible, and representation made to local or provincial government officials.

Urban clubs cannot perhaps undertake as much practical work, being further removed from actual physical control of resources. But they can do a great deal to educate city and town dwellers to the urgent need for conservation, to make them more aware of their very real dependence on natural resources for their livelihood, possessions and recreation. Publicity should be a very large part of the work of urban clubs, together with campaigns for wildflower and wildlife protection within and around the city or town. City dwellers may be educated in outdoor "good manners" so that when on country vacations they will respect the sanctity of trees and grass and wildlife, and appreciate rather than destroy. Representations may be made to government officials on conservation policies.

Junior Conservation Clubs

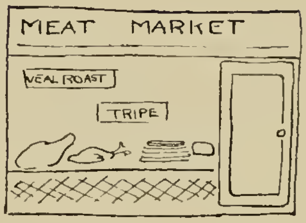
It is most vital that the generation now in childhood grow up with a thorough understanding of the important principles of conservation. This educational work should not be left entirely to the already overworked

NATURE'S IN THE CITY — TOO!

Be Curious! Look! Wonder Why!

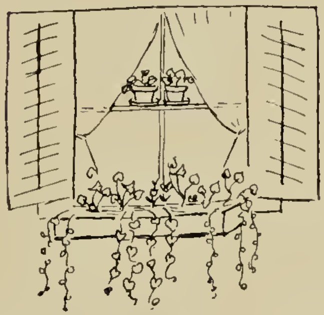
FOUND A SCALLOP SHELL?
COUNTED THE FINS ON A FISH? –

WHAT IS BUTTERMILK?
WAS A PRUNE A PLUM?



WHAT IS VEAL?
WHAT IS TRIPE?

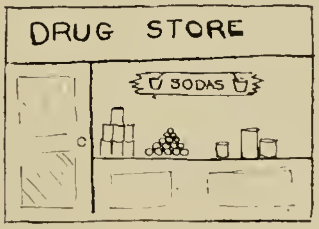
EVERY VACANT LOT HAS
A PLANT OR TWO.



PEOPLE'S WINDOWS AND
WINDOW BOXES WOULD KEEP
YOU BUSY FOR MONTHS.

EVERY TREE HAS BUDS,
LEAVES, FLOWERS, AND
FRUIT. WATCH FOR THEM.

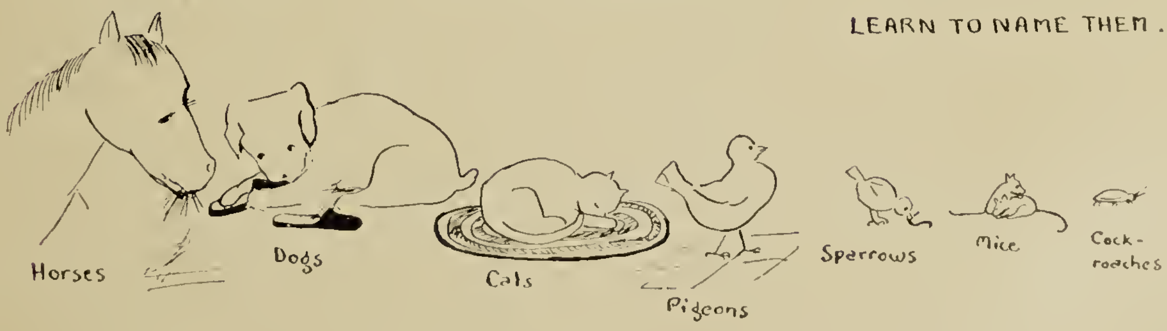
KNOW THE CARE OF
COMMON PETS?



CHOCOLATE BEANS AND
VANILLA ORCHIDS.

LEARN TO NAME THEM.

To Say Nothing Of —



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school teacher, though in many cases the teacher may be the leading spirit or at least take an active part in leadership. But conservation is a community affair, and Junior Conservation Clubs for young people 10 to 20 years of age should be a feature of every community.

Junior Conservation work may be fitted in to the programme of an already existing organization, such as Boy Scout or Girl Guide groups, or Audubon Junior Clubs; it may be an extra-curricular school activity; or an independent Club may be formed. The Junior Club should be allowed to function as an independent group but it needs good adult leadership and assistance from the Adult Conservation Club, local school officials, or other interested organizations or individuals.

Junior Conservation Clubs should be to a great extent nature clubs. To acquire a knowledge and love of plants and animals and an understanding of their relationships to each other, to their environment and to man, and to appreciate the aesthetic and economic advantages of a well-ordered wildlife community, is to prepare the mind for ready acceptance of the more technical details of conservation practice in forestry and agriculture.

PROGRAMME: A Junior Conservation programme should be one of *doing*, and it should focus attention on *local* conditions. Many of the study suggestions given in various sections of this book may be used by leaders of Junior Conservation Clubs, and a number of additional programmes and projects are briefly described below. In some instances, projects should be participated in by all members, while others are more suitable for a small group or for individuals. Members should submit written reports of their completed projects to the Club secretary and records of both individual and Club accomplishments should be kept. Where a Club is large, say more than twenty members, it is advisable to have different programmes for different groups, depending on age, amount of knowledge already acquired, interest and ability. Whether one topic should be studied exclusively for several weeks or even months, or whether a varied programme should be presented through the year, is a matter for the leaders to decide. We have space in this chapter only to make some brief suggestions, which we hope may be helpful.

BIRD STUDY: This should include identification, study of predators, study of Migratory Birds Convention Act and game laws, bird surveys on certain areas and study of habitats, planting of food and cover plants for birds, winter feeding, making and erecting bird houses and bird baths, observation of nesting, feeding and migration. The economic significance of birds should be very strongly emphasized, and beneficial and harmful habits of locally common species studied thoroughly. Discussion should include such topics as: the value of birds to man; factors that affect our bird population; how individuals and organizations can aid in the conservation of birds; and many other subjects.

MAMMAL STUDY: The large and small mammals of the district should be observed, their feeding habits studied, their habitats noted, and their economic significance discussed.

FISH STUDY: Local fish species should be named and their habitat and food requirements studied. Discussion should take place on such subjects as fishing regulations, fish management, and the effect of modern conditions on fish life, e.g., the irregularity of stream flow due to dams, floods and drought; the removal of protective cover of trees and grass and its relationship to water conditions; drainage of marshes, lakes and ponds; pollution of lakes and streams; effects of forest fires, etc. Field trips should be made to study aquatic plants, food and cover, observe spawning, take stream temperatures and note sources of pollution and other conditions. Streamside plantings of quick growing trees and shrubs such as willow, may be undertaken. Visits to fish hatcheries, rearing ponds, or lake and stream improvement projects, will be helpful.

TREES AND FORESTRY: A most important part of the programme. The value of trees as soil builders, water holders, wildlife habitat, and as sources of wood and wood products, an acquaintance with the common local species, study of woods, twigs and leaves. Forest fires and their prevention should be thoroughly discussed, and if possible a fire tower visited. Visit a burnt-over area to study effects of fire on trees, wildlife, soil, etc. Instructions on the correct handling of camp fires may be given. Visit a tree nursery or reforestation station. Plant trees on eroded areas, beautify the school grounds with trees.

SOIL MANAGEMENT: Learn about the different kinds of soil and their suitabilities, examine samples of soil from your district. Learn about and practice on a stipulated area, prevention and stopping of erosion, terracing, strip cropping, planting of trees and shrubs, and pasture improvement. Establish a farm nursery, practice selective cutting in a woodlot.

Conservation should be taught chiefly in the field. To behold an eroded hillside, a burnt-over forest area, a flooding river laden with silt, to undertake some constructive remedial project no matter on how small a scale, is to understand the meaning of conservation more deeply than could be conveyed by a thousand books and lectures, though these too have their place in the conservation programme. According to inclination and ability, young people may choose many mediums to crystallize their thoughts on conservation — photography, posters, bulletin boards in schools and libraries, essay contests, collections, displays at fall fairs, talks by members at Club meetings or in classrooms.

Modelling is an excellent educational medium and may be applied successfully to conservation. All members may take part in such a project. Select an area in your community which is in need of improvement, and make a model to scale showing contours. Then help the children to decide how it should look under proper treatment and show on the model features such as woodlots (use tiny twigs from evergreen trees), ponds (scraps of mirrors), contour ploughing on slopes, trees and shrubs as wildlife habitat on the borders of fields, etc. Older Club members will enjoy surveying the area to be modelled and reducing its features to scale for the model, planning the "improvements" to be made on the idealized miniature, and even the youngest member can take part in the collection of materials for the project, and in the actual modelling and addition of features. The only danger in such a project is that the fun of building the model may eclipse the original purpose of the project. As much time or more, should be spent in planning and discussing as is actually spent in manual work.

SCHOOL AND COMMUNITY FORESTS

The cause of conservation may be served excellently by the establishment of school or community forests. Every rural community should have a place that the people can call their own, where they can get together for social and recreational purposes and which they have worked together to create and maintain.

A community forest may cover anywhere from 1 to 100 acres or more, and its functions are many, depending partly on the size of the area. It may be used as a laboratory and demonstration area in forestry and wildlife management by and for the benefit of the people of the community; large areas may be so located that they protect watersheds serving the community; if possible the area should be large enough to include playing fields, picnic grounds, fishing and swimming facilities, and perhaps a community hall; and every community forest should be a sanctuary for wild animal and plant life of all kinds.

Land for school or community forests may be acquired in various ways, by purchase or gift. In cut-over areas lumber companies often own small tracts within proximity of schools or communities, which may be obtained very cheaply. Tax-delinquent lands may be secured by paying taxes and back interest. County, township or municipal councils, or a combination of these, will often undertake the purchase of land for school or community forest purposes. The present arrangement under which a number of county forests are being managed in Ontario is that the county purchases the land and turns it over to the Provincial Government for development and management for a period of 30 years, at the end of which time several options are provided whereby the province may take over the land, paying the county the original purchase price, or the county may take over the land, paying the province the cost of development, each of these options without interest. Enquiries addressed to your provincial, county and local governments will be almost sure to reveal some possible arrangement for your particular community undertaking.

However land is acquired, whether privately or through governmental assistance, it is wise, in view of the enduring nature of the project and the necessity for continuous supervision and upkeep over a long period of time, to have the title to the land held by the county, township or municipal government or, in the case of a school forest, by the school board. The property should be managed by a non-political, non-sectarian commission of at least three people, and as many people as possible in the community should be encouraged to take part in the planning, establishment and maintenance of the area. As forest planning and management requires a considerable degree of technical knowledge, it is advisable to take full avail of the services of your local provincial forester, if possible including him on the management commission. Provincial governments are always glad to co-operate in such ventures by supplying helpful literature and quantities of young trees for planting, free of charge.

If there is a choice in the matter, the site of the forest should be selected with care, to ensure that it is conveniently accessible to the people to whom it will belong; that it possess, or have possibilities of, scenic beauty, and that, if possible, it cover a watershed area to protect the water supply of the community.

Plans for development and a statement of purpose should be carefully drawn up, and placed in writing to ensure continuous operation under future management. Many practical considerations will present themselves. For instance, if a stream runs through the area its possibilities will be much increased, but if such is not the case an artificial pond may be built and stocked with fish, to provide additional recreational and aesthetic enjoyment. Playing fields and picnic grounds with open fireplaces are desirable, but should be limited strictly to one section of the area, with the balance left in a natural state. The establishment of nature trails and perhaps a small nature museum, are projects which will be undertaken joyfully and with great benefit by the school children. The young people will also be of great assistance in actual planting of trees and care of the forest, thereby learning much of forestry and conservation. The use of a little ceremony in tree-planting, such as having each person plant a tree which will bear his name permanently in the form of a little tag including the date planted, anniversary planting ceremonies, etc., will help to arouse and maintain public interest in the project.

No one is too old or too young to be given a share in the shaping of a community forest. It is very important to keep in mind always that this is a community affair, requiring the thought and labour of everyone in the community served, and bringing benefits to all alike. As with every task that was ever undertaken by a group of people, leadership and co-operation must be present in large quantities. Long-range vision is needed, too, for often the benefits of the venture will not be felt by the generation undertaking it. Trees grow slowly, but once grown they endure and bring blessings to many people for many generations—blessings material, mental and spiritual.

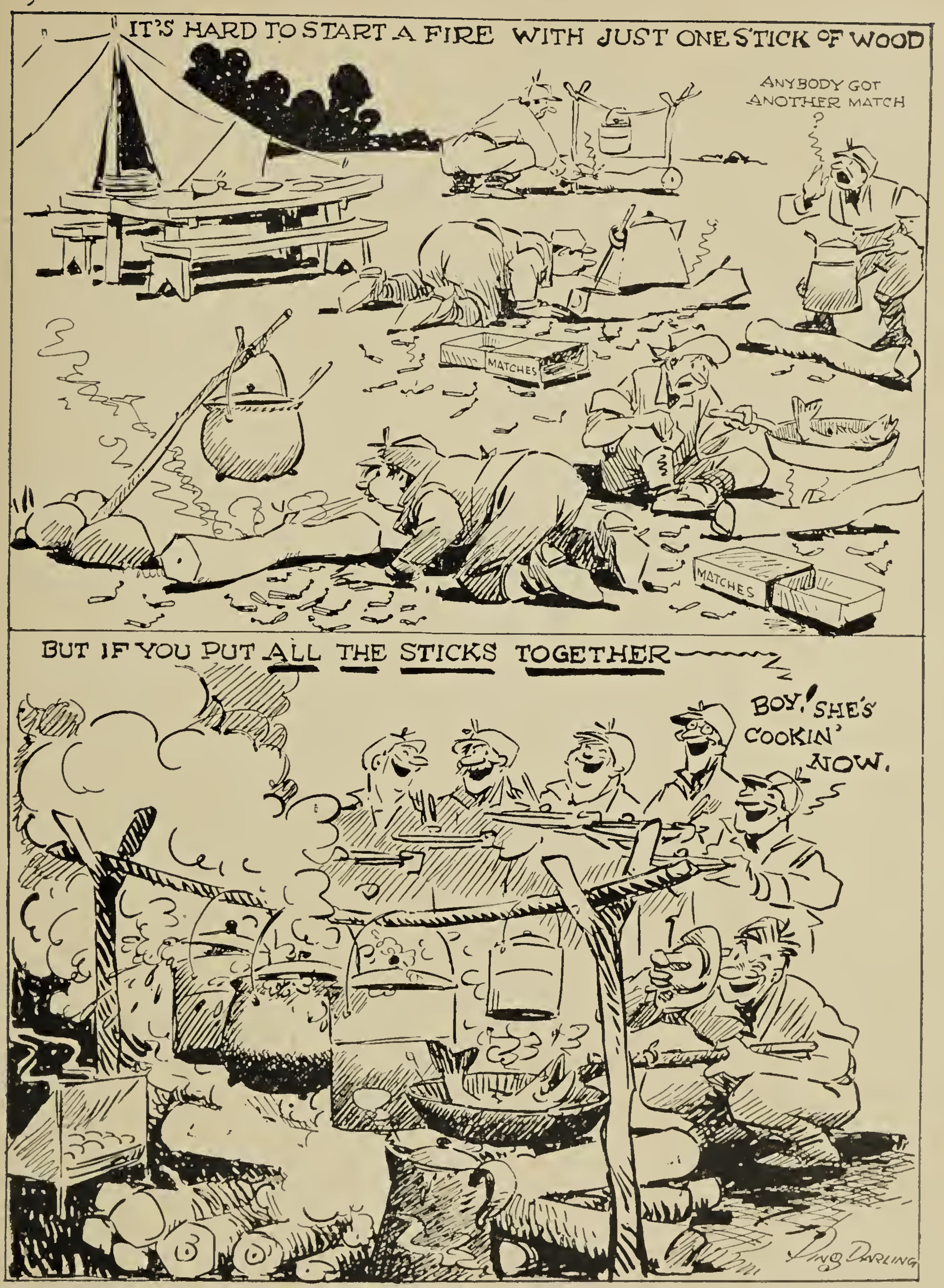
Why not explore the possibilities for such a project in YOUR community? Perhaps you can start a ball rolling, with who knows what great consequences. Good luck!

Conservation and Citizenship

IRA N. GABRIELSON

It is so obviously in the national interest to care for and use wisely the natural resources of soil, water, forest, grasslands, and wildlife, that it would seem a simple matter to establish and maintain a good conservation programme. The contrary, however, is the case. There is no panacea, and no simple solution will ever be found; but six needs for which there are remedies may be suggested.

1. The greatest need is for an alert, intelligent conservation group in every community. Each group should challenge every project that will radically alter vegetative and water conditions in its section. Much needless damage may be averted if, in drainage projects, the construction of dams, the establishment of industries that increase pollution, or in great land-selling programmes,


IT'S HARD TO START A FIRE WITH JUST ONE STICK OF WOOD
ANYBODY GOT ANOTHER MATCH
?
MATCHES
MATCHES
BUT IF YOU PUT ALL THE STICKS TOGETHER
BOY! SHE'S COOKIN' NOW.
Ding Darling

THIS COMPREHENSIVE BOOK brings the message of conservation to sharp focus via stimulating reading, basic information and beautiful pictures. Put it to work! Bring it to the attention of friends, schools or public libraries. Encourage them to send for a copy, that they in turn will spread the message of conservation and benefit the nation. Let's all co-operate! Do your best, won't you?

those who promote the "developments" are forced to give consideration to all the probable results before the work is undertaken, and to render an accounting before the bar of public opinion. Vigilance in these respects will always be necessary. There will ever be grasping hands eager to despoil our basic resources, and there must be strong and resolute forces to oppose and control the spoilers.

2. The next greatest need is to have more of the population understand conservation and to get it so fixed in their minds that it will become part of their philosophy of life. There is, after all, only one certain way to accomplish this, and that is by education in the schools and in various groups and associations, in fact, in every conceivable way. Conservation forces might make much more headway if, instead of arguing over details, they would devote their energies to seeing that the educational policy on conservation is firmly established. Let the schoolmasters work out the pedagogical details, which to the conservationst are relatively unimportant. It makes little difference *how* it is done, if only it *is* done.

3. Persistency in the conservation movement is essential. Constant education and unremitting public pressure are needed to convince all concerned that no matter how far this country has succeeded in restoring its forests and wildlife and in conserving the productivity of its waters and the fertility of its soils, for all time to come it will be necessary to see that these resources are never again exploited to the point of destruction. On the average, only the annual increase should be used; the fertility used in growing crops must be replaced; and forests must be regrown as fast as they are cut. The grasslands, once restored, must never again be overgrazed; and never again should more birds or more mammals or more fishes be taken in a year than are warranted by the year's crop. If that one idea is seriously accepted and acted upon by every group and interest engaged in enterprises affecting the natural resources, the problem of conserving these resources for perpetual use will be largely solved.

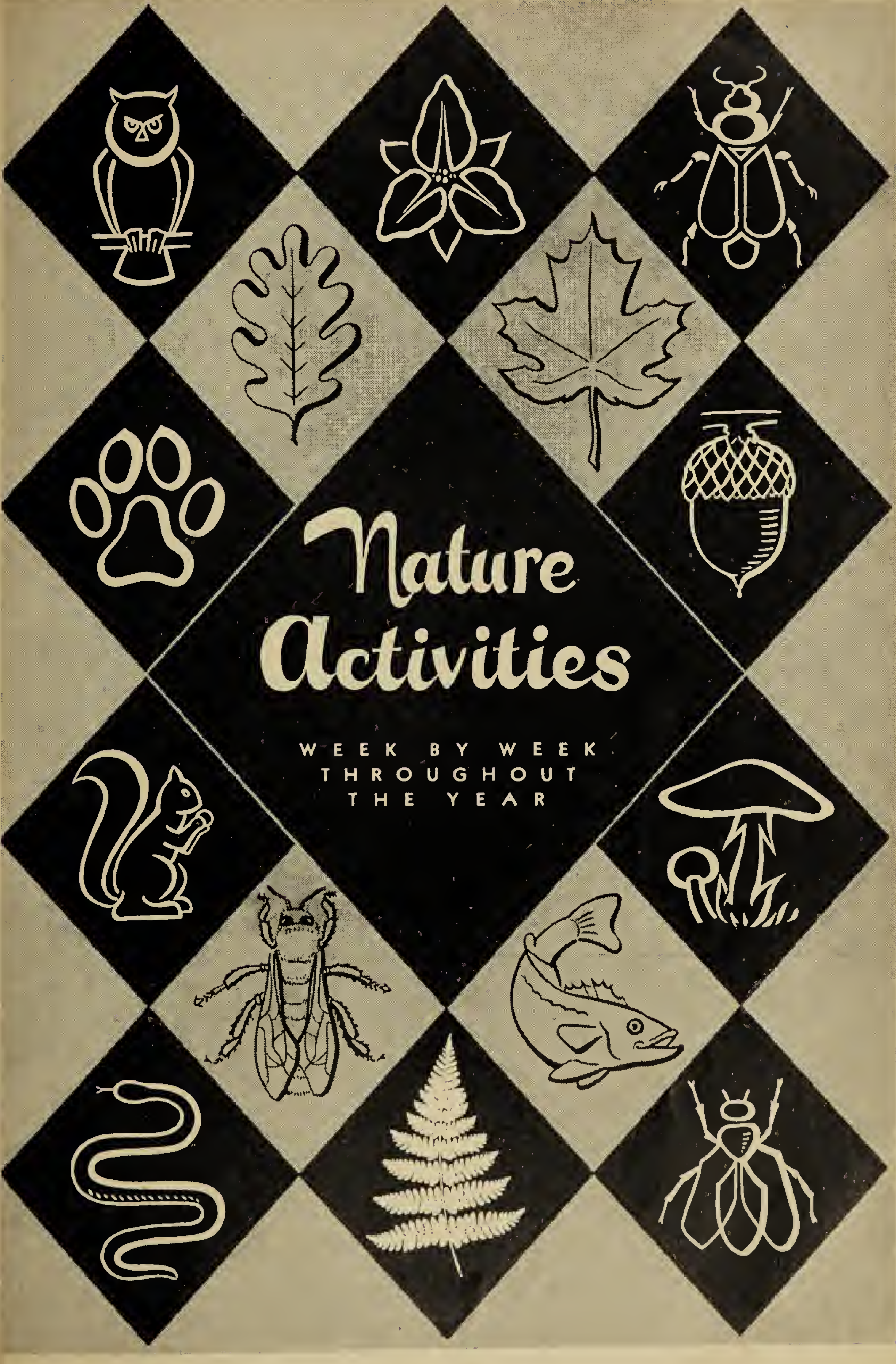
4. Next on the list is the need of more and more research. The time will never come when it will be possible to rest secure in the knowledge that all conservation problems have been solved. The constantly shifting industrial, economic and social factors in this country will always create new conservation problems—new problems in preservation, utilization, and restoration. The only way that fact can be faced with any assurance is to have a sufficient force of technically trained men constantly applying themselves to the solution of conservation problems.

5. To provide for constantly better use of soil and water resources, the present trend toward restoration of environmental conditions, whether of forests or grasslands, marshes or lakes, must be carried much further. In adopting and executing such a programme, we will only be paying for past mistakes. To realize errors is always painful and in many cases to make up for them is expensive, but if the people of this country are to get on a sustained basis of living, a programme of regulated use and full restoration must be adopted once and for all.

6. Environmental restoration (the putting of nature's forces to work for men) and limitation of the harvest to the crop produced have proved successful in increasing stocks of game and fishes. The trend is distinctly upward where these methods have been faithfully adhered to. The scope of rational management should be greater, and as the programme continues the effect of increasing natural production will be cumulative. The most uncertain factor is not management itself but public support for a suitable and effective programme that may be neither a spectacular performance nor a crusade. Each square mile of territory improved for wildlife will go on producing annual crops while other lands are being improved; each stream cleared of pollution will make its annual contribution of fishes while other waters are being restored. The conservation battle cannot be a short, sharp engagement, but must be grim, tenacious warfare—the sort that makes single gains and then consolidates these gains until renewed strength and opportunity make another advance possible.

It is yet to be demonstrated whether conservation forces or the people can wage that kind of fight. Much of our "success" has been in reality appalling wastefulness. Now we face the hard task of putting to work natural forces in restoration and of staying tirelessly on the job throughout future years.

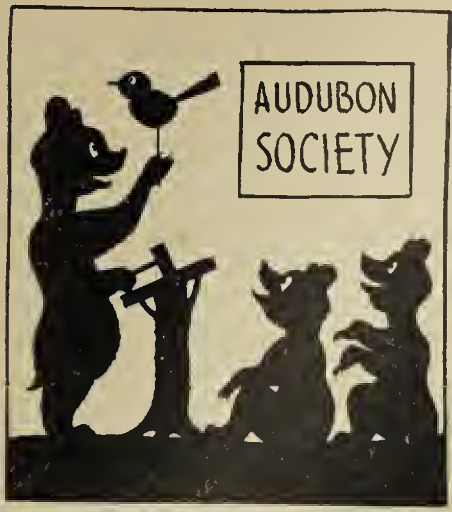
This is an excerpt from the final chapter of Ira N. Gabrielson's book, *Wildlife Conservation*, published and copyrighted by the Macmillan Company.



Nature Activities

WEEK BY WEEK THROUGHOUT THE YEAR

FLOWERING DOGWOOD



SECTION THREE

Guide to Nature Activities

TWELVE CHAPTERS

THE materials and forces of nature with which the child is surrounded contribute to his joy and well-being in innumerable ways. However, the extent of this contribution is limited by his knowledge and skill to recognize and use the beautiful and useful of the common things around him. Natural Science activities should guide and strengthen the child's normal, happy relationships with Nature: leading him to the fields and woods; helping him to become acquainted with and call by name the common wild flowers, trees, birds, and other living things of his environment; cultivating in him an abiding love of the out-of-doors; teaching him a way of living in harmony with Nature and his fellowman.

OBJECTIVES

His science activities should help the child to make simple but useful generalizations related to the factors of his environment and their interaction upon each other. These general concepts or understandings should emphasize adaptations and interdependence of living things, including man; set forth useful ideas in respect to scientific conservation; and in other ways assist the pupil to interpret and understand what he sees taking place in the world around him.

Science activities in the elementary school should be simple and direct, but nevertheless conducted on a basis which emphasizes accuracy and thoroughness, and which develops the pupil's skill and confidence in the scientific method of solving problems. The child should learn to recognize problems, and many science activities should be presented to him in such a way that he sees them as a challenge, as a problem to be solved by his own initiative and skill. Emphasis is to be placed on searching and discovering on the part of every pupil.

As a result of his work in science, the child should develop a scientific attitude. He should form the habit of basing judgment only on facts. He should become open-minded, intelligently curious about his environment, and more skilful in evaluating propaganda. He should learn that what he observes taking place around him does not just happen but is the result of definite natural or man-made conditions.

Increased understanding on the part of the child should lead him to a deep appreciation of the usefulness of many forms of plant and animal life, the basic order of the universe, the beauty of the common living things around him, and the need to conserve natural beauty, the soil, and other natural resources. Appreciation should result in the development of ideals in respect of good craftsmanship, honesty, service, and cooperative effort, and the ability through practice to translate these into social conduct of a high order, as, for example, when the child plays his part in enterprises to beautify the school grounds or adjusts his conduct when outdoors to conserve rather than to destroy the living things around him.

PROCEDURE

The course in Natural Science is essentially an activity programme. For many of his science activities the child's "laboratory" should be the woods, fields, sky, ponds, streams, gardens, and parks of the great outdoors. Pupils should be encouraged to make many observations on the way to and from school. Activity means actually doing things: hiking, thinking, planning, observing, experimenting, keeping accurate records.

Natural Science activities in school should largely consist of: thoughtful pupil discussion and interpretation of outdoor observations; teacher giving hints of further possible observation; performing experiments; planning home experiments; building science apparatus; searching for information; solving problems; thoughtful generalizing; observing plants, animals, rocks, etc., brought to school; studying pictures in preparation for outdoor observations; planning and participating in field trips and excursions; putting observations and knowledge into visual forms, such as charts, drawings, models, sandtable arrangements, illustrated note-books, etc. Notes and other science records should be accurate accounts of the pupils' own investigations and observations, not facts dictated by the teacher. Window boxes, aquaria, specimens, such as grains and soils, and similar materials should be considered essential.

All Natural Science activities must be carried on during appropriate seasons when essential outdoor activities and observations are possible. Topics, such as birds, wild flowers, and conservation, should not be dealt with in a short series of formal lessons and then discontinued, but observations and activities should be carried on throughout the year as environment and opportunity offer. All pupils should participate in a broad, well-balanced science programme, but each child should be encouraged to engage particularly in activities suited to his experience, talents, and interests.

As the child takes part in science activities, his science vocabulary should steadily increase. Numerous stories should be read and told to the pupils, especially in the lower grades. Every pupil should also be encouraged to read extensively.

Planning ahead is essential. Teachers will do well to organize tentatively the season's science programme in advance in order to make provision for essential materials and to be prepared to discuss the programme with the superintendent of schools during his visit.

It is important for teachers to realize that such activities as colouring outlines of plants and animals, learning nature poems, studying pictures, and memorizing facts outlined by the teacher are of little or no value unless definitely related to and accompanied by outdoor or classroom experiences with the subjects concerned. Teachers should remember that it is not the length of time spent or the amount of subject matter dealt with, but the joy the child experiences, the extent to which he is stimulated, the knowledge he acquires by his own effort, the skills, appreciations, and attitudes developed, and the abiding wonder and interest aroused, that give value to Natural Science as a school subject.—*Saskatchewan School Curriculum*

Adventuring in Nature

BETTY PRICE

NATURE is an exciting, adventurous journey of discovery into the world of plants and animals, rocks and minerals, the weather and the sky. Its expeditions and explorations disclose the interesting and important things about blades of grass, spider webs, hawks, paving stones, eroded hillsides, the flight of birds, the majesty of the night sky. With "watch living things live" as a password to nature, eyes are open wider on field trips, gardens are planted, and experiments made with seeds and seedlings; trees are adopted, and caterpillars, pollywogs, pet dogs, or any one of a thousand other living things are watched day by day. Nature adventures reach out to include games, music, drama and the fun and skill of making things—bird houses, plaster casts, designs from nature—for these activities can extend the nature experience.

Nature seeks more than that the adventurer bring home "specimens", learn ten trees, dissect an animal, or make a blue print. It gathers many varied experiences together

to create a feeling of enjoyment and "at-homeness" in the out-of-doors; it finds room for wonder and enthusiasm, the spirit of adventure, and a spontaneous delight in discovery. It would reveal something of the order, bigness, complexity and majesty of the world of nature to those who live in it.

THE LEADER

You need not wait until you are equipped with academic science courses or a degree in science before starting adventures in nature, although you cannot know too much, and everything to be had from independent study, field trips, summer training, or college courses will add immeasurably to your ability as a leader. But too many people have failed as leaders of nature activities because they thought knowledge the only requirement. The successful leaders have been those who have brought to their groups first of all a contagious, sincerely enthusiastic interest in nature. To this they have added the ability to lead a group and to plan a programme of interesting activities. They know they need not fear saying, "I don't know" in answer to a question, for they usually add, "Let's look it up," and in doing so retain the respect of the group as well as encourage it to trace down unknown facts.

PLANNING THE PROGRAMME

Nature can be fitted into a recreation programme in a number of ways. The programme may be planned in the form of clubs centring around hobby interests, such as general nature clubs, mineral clubs, pet clubs, bird clubs, star clubs, and the like. Or it may be one of the many activities of other groups or clubs. The handicraft group, for instance, may use designs from nature and investigate the source and treatment of the raw materials they use—the clay, wood, metal, leather. The drama club may put on a conservation play. Nature is an important part of the programme of Boy Scout, Girl Guide, and similar groups.

Choose as your first nature activity one which is timely and appropriate and which develops an interest already shown by members of the group. Let it be one which involves doing something. It is best to start with a group small enough to handle easily. Later others who show real interest in the activity may be invited to join the group.

Interest in nature does not start and stop with the opening and closing of a class session or club meeting. Between meetings there are many projects which may be carried on alone or in groups of two or three that will extend the scope of the programme. There is need for flexibility, too, in the routine of classes and meetings. A weekly meeting time may be spent on a hike which will require extra hours the next day to look after the "finds" brought home, to make aquaria, to label specimens, to look up unknown species, or to care for live pets.

Here are a number of important points

which will help you in planning a successful and worthy programme:

Begin With Local Materials. Help people to see the romance of the thing at hand. Too often leaders stress strange animals and plants from distant places, ignoring the fascinating objects in their own backyards.

Work in the Fields. Natural objects in their natural setting are the ideal materials for observation. In order of their value in nature programmes, here are some ways of "discovering" nature: (a) going out of doors to find natural objects in their natural setting, whether they be plants, animals, rocks, or stars. Nothing can take the place of first-hand experience! (b) bringing living animals and plants from their natural setting or raising them in an environment you build for them; (c) handling stuffed animal specimens or examining pressed flowers; (d) looking at pictures of birds, animals, rocks and stars; (e) just talking about them.

Observe Everything. Use all your senses in discovering what is interesting and important about each thing you see. Use not only sight and hearing but also the neglected senses of taste, touch and smell. There may be a world of difference between *looking* and *seeing*.

Plan Seasonal Activities. Follow the "rolling seasons" by basing your programme on seasonal changes. Focus attention on what is important and different about each aspect of nature at a particular season. For instance, spring is the ideal time to look for tree blossoms; summer, for discovering leaf types, making leaf prints, and examining fruits of different trees; fall, for watching to see which trees lose their leaves, how they fall, and which change colour; and winter, for identifying trees by bark, silhouette, and twigs. Hikes and trips afield will be more frequent in the warmer seasons, so plan the indoor trips to museums, factories, and neighbourhood streets when weather does not permit many trips further afield. Indoor activities such as lectures, talks, slides, movies and making bird houses, feeding tables, and other equipment, also fit well into the colder season and help keep interest alive through the winter months.

Fit the Programme to the Group. Nature is enjoyed in different ways by different ages. Very small children are often most interested in the shapes and habits of familiar plants and animals, in stories about them, and in informal dramatics and simple crafts and gardening. Children from nine to twelve usually have a very intense interest in all of nature and enjoy making collections, gardening, raising and caring for pets, nature games, and more formal dramatics and clubs. They especially like hikes, field trips, and cook-outs. Teen-age children enjoy these and also enjoy "service" projects such as developing a nature trail, helping with the organization of a playground museum, making bulletin boards, and assisting as junior leaders with the nature programme for younger children. They are interested in principles of life—the adaptation of life to environment, the inter-relationships of living things, and conservation. Specialized study, trips, talks and papers have their appeal to this group of older children.

Outline a Long-term Programme. You will need to adapt your list of activities to the constantly changing interests of the group, but it is important to have a general long-range plan mapped out in order to keep the programme from becoming scattered, one-sided, or purposeless and ineffective.

Tests and Ranks. If you use tests and ranks, see that the greater emphasis is not on merely naming things, but on observation. Avoid tests which depend on answers found only in books and administer any tests in such a way that self-competition or improvement in knowledge is the chief interest, and not the winning of an award or competing with others in the group.

Stress Important Principles. To develop a real understanding and appreciation of nature, open the eyes of your group to the fundamental principles of natural life. Keeping these principles in mind will give unity and direction to a programme which otherwise may tend to be a scattered series of relatively unmeaningful activities. Each kind of plant and animal has its own peculiar way of growing and developing; each one has its own life story. The discovery of these different ways of growing and developing opens the way to an appreciation of the complexity and diversity of living things, and to a realization of the far-reaching effects of man's interference.

An understanding of life histories, of the problems of growth and development, of the

LET'S GO TO THE SEASHORE !!

Watch the Acorn Barnacle under water!

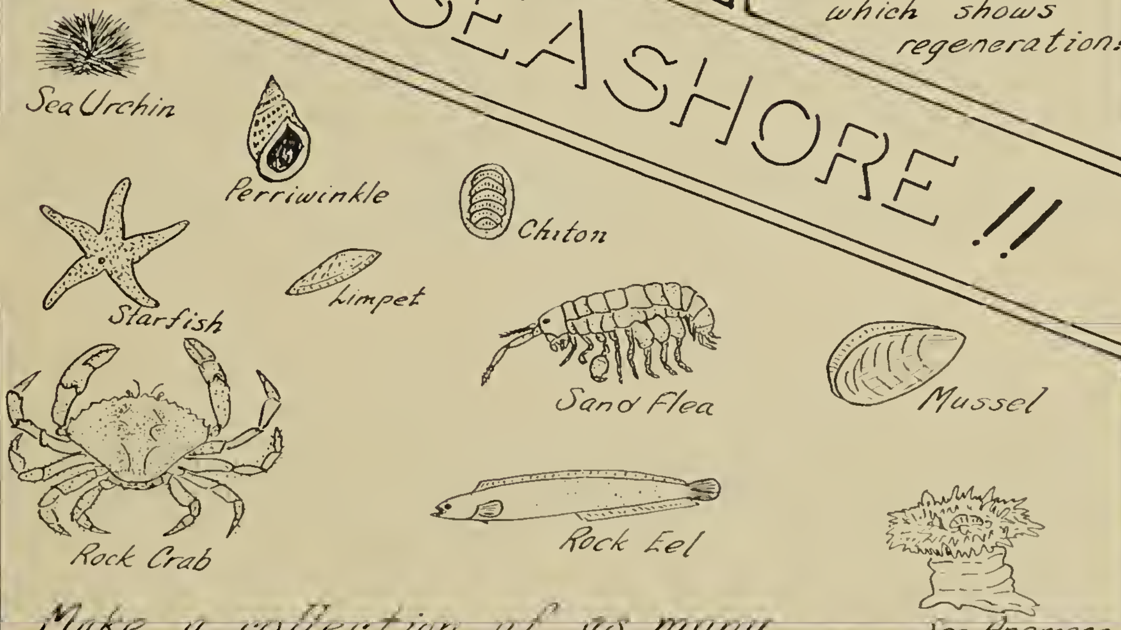
Did you know that it stands on it's head and kicks the food into it's mouth ?

Watch a fisherman dressing his fish! Open the stomachs of several codfish and see if you can name the animals they have eaten!

Lay a starfish on it's back and find out how it rights itself!

How doe's the starfish eat a clam or a mussel?

Can you find one which shows regeneration?



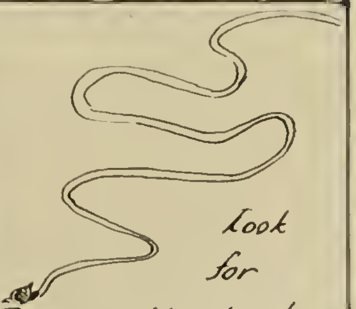
Make a collection of as many different animals as you can find in one tidepool!

Sea Gulls are often called Seashore Garbage Collectors!

Why are they so valuable to man?

The Lobster swims

backwards! Can you name other animals that do the same?



Look for Perriwinkle trails in the sand!

—J. Lynton Martin

struggle for existence, of the inter-dependency of all living things, and of the natural balance of nature, enables man to help himself in his struggle for existence through his use and control of nature. He has not always used his knowledge wisely, and so in some ways has increased his problems. He has destroyed forests which would have prevented floods and soil erosion; he has ruthlessly or ignorantly killed wild life which would have been helpful to him, and he has used the soil so carelessly that now there are dust-bowls and deserted farms. He has destroyed many of the beauty spots which should have been saved for his recreation, and he has misused many of the other natural resources necessary for better living. Such lack of understanding must be paid for.

Only of late has man become aware of these mistakes and changed his ways. He must continually and increasingly do the things which help nature to help him, if he is to survive and if he is to make the struggle of living easier. It is not enough for the government to pass game laws and make game refuges, and for the farmers to learn to use the soil wisely. The wise use and treatment of wild life and natural resources must become a part of everyone's normal thinking and acting. Each must realize that without plants, insects, or other animals, man cannot survive. Each person must come to know and understand that every act, however large or small—picking berries and wild flowers, planting gardens, polluting streams, draining swamps, clearing and tilling the ground, spraying trees, or killing wild animals of any kind—helps or harms the wild life of a region and may help or harm man through upsetting the balance of nature.

Field Trips and In-Town Excursions

BETTY PRICE

No tune by any Pied Piper has more magic drawing power than "Let's go somewhere." They'll crowd around you, the young of all ages, crying "Yes, let's!" They know the fun of walking, of exploring, of adventuring!

FIELD TRIPS

The hike that the group is so eager about offers you the best approach to nature because things are found in their natural setting, uncollected, unlabelled, unmounted, and unstuffed.

"Hikes" and "field trips" are not always one and the same thing. We are apt to think of hikes as rather long, vigorous walks in which the fun of exploring new territory, of getting there and back, and perhaps a picnic are the high points. In a field trip the joy of walking and exploring is there, too, but the exploring includes a more conscious consideration of the trees, flowers, ferns, insects and the like along the way. Thus a field trip is apt to move more slowly and travel a shorter distance than a simple hike, although the two may be combined or may overlap. The further and faster you go, the less time there is really to see what you are passing.

Field trips usually make us think of trips in spring, summer or fall on bright, clear days. But any time is the time to go on a field trip, whether it's summer, winter, spring or fall, five in the morning, twelve noon, or ten at night; whether it's sunshiny or rainy.

If this is to be a children's trip, plan the trip for children of nearly the same age. Keep your group under twenty-five in number if you can. Everyone will have more fun and will see and learn more. A small first-aid kit should go on every hike. Make sure you carry water if none is to be obtained en route. On the way or in the field keep the group fairly compact so that new discoveries may be shared and lag-behinds do not take a wrong turning in the trail. Set the pace to that of the slowest, not the fastest.

Those who enjoy the out-of-doors have built a code of outdoor good manners, based on consideration for others. It involves leaving gates as you find them; respecting "no trespass" signs and privately-owned fruit and flowers; refraining from crossing cultivated or ploughed fields, orchards or gardens; picking up and burning, burying, or carrying home the remains of a picnic; and putting

EXPLORING is fun. There is a thrill in sharing your own discoveries and examining the exciting "finds" of others. (Below) Bird watching in the hush of dawning brings peace to the heart.

WELL LAID PLANS

MAKE THE OUTING A SUCCESS

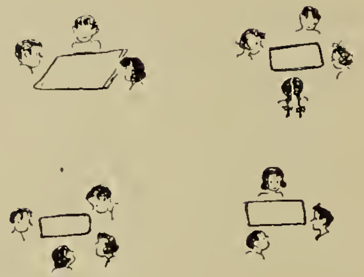
FOR ANY OUTING –

LET GROUP TALK IT OVER AND MAKE A PLAN TO INCLUDE –

Where to go – and when.
When to start and return.
Where to meet.
What to take for program – cooking.
Money needed
What to wear.
Permissions needed.

STEP 1.

Talk it over all together. Decide when to go, where to go, what to do.



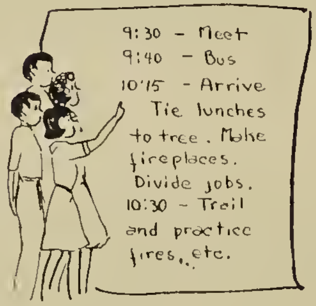
STEP 2.

Divide into committees.

Where to go?
Lookout Park
Meet at Main and South – 9:30.

COMMITTEE #1

Where to go – where to meet. Do we need any permissions


9:30 – Meet
9:40 – Bus
10:15 – Arrive
Tie lunches to tree. Make fireplaces. Divide jobs.
10:30 – Trail and practice fires, etc.

COMMITTEE #2

What shall we do?

To Eat
Menu?
Amounts?
Cost?
Kettles needed?
Anything else?

COMMITTEE #3

What shall we eat?

COMMITTEE #4

What equipment do we need?

COMMITTEE #5

What shall we wear? (Have a fashion show or exhibit).

ADULT RESPONSIBILITIES

Enough leaders to take care of emergencies.
First Aiders.
Permissions – to build fire – to use property – from parents, etc.
Safety of water supply.

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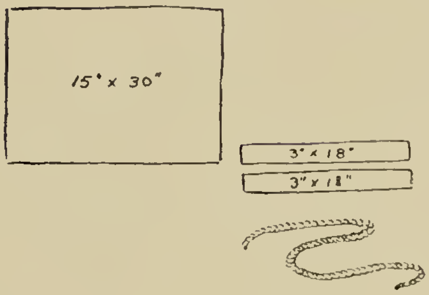
MAKE YOUR OWN HIKE KIT

YOU WILL NEED –



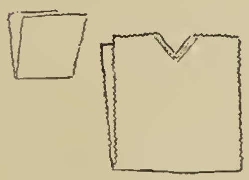
MATERIALS: –

DENIM, UNBLEACHED COTTON, AWNING CLOTH, IN FACT, ANY FIRM CLOTH.

CLOTHESLINE OR ROPE, 2 YARDS LONG.

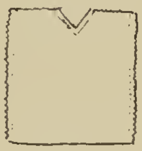
TOOLS: –

NEEDLE, THREAD, SCISSORS.



STEP 1

FOLD STRIP IN HALF. CUT V'S IN TOP. HEM.

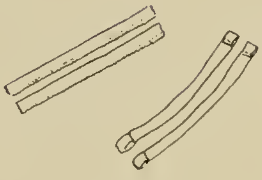


STEP 2

SEW SIDE SEAM LEAVING 1 INCH AT BOTTOM OPEN.

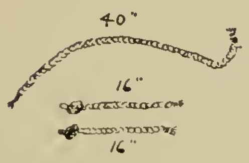
STEP 3

HEM TOP



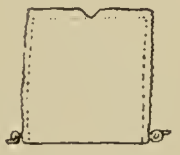
STEP 4

FOLD STRIPS LENGTHWISE. STITCH SEAMS. TURN INSIDE OUT. MAKE 1 INCH HEM IN EACH END.



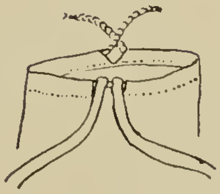
STEP 5

WHIP BOTH ENDS OF LONG ROPE. WHIP ONE END OF EACH SHORT ROPE. KNOT OTHER END.



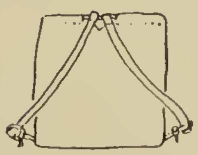
STEP 6

INSERT KNOT END OF SHORT ROPE IN OPENINGS IN SIDE SEAMS. STITCH.



STEP 7

THREAD ROPE THROUGH HEM. START AT ONE V, THROUGH TOP HEMS OF STRAPS, BACK TO STARTING PLACE.



STEP 8

TIE SHORT ROPE THROUGH OTHER HEMS OF STRAPS. ADJUST LENGTH OF STRAPS BY SHORT ROPES.

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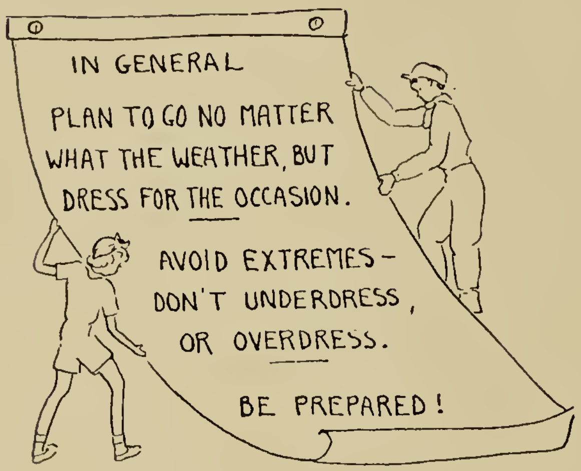
AN OUNCE OF PREVENTION

TALK OVER, IN YOUR GROUP, HOW TO DRESS FOR ALL OCCASIONS



IN GENERAL

PLAN TO GO NO MATTER WHAT THE WEATHER, BUT DRESS FOR THE OCCASION.

AVOID EXTREMES – DON'T UNDERDRESS, OR OVERDRESS.

BE PREPARED!

WALKS IN THE RAIN ARE FUN – IF YOU HAVE RAINCOATS, HATS, RUBBERS OR BOOTS, AND DRY CLOTHES AT HOME.

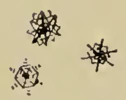
DON'T PLAN LONG STOPS ALONG THE WAY.

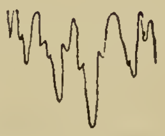
KEEP MOVING.

WHEN GOING CROSS COUNTRY, OR IN THE WOODS, PROTECT ARMS AND LEGS FROM BRIARS – WEAR JEANS OR SLACKS THAT ARE SMOOTH – WEAR KNEE SOCKS WITH SHORTS. FOR REAL CROSS-COUNTRY HIKES, KEEP HAIR TIED BACK.

IN HOT SUNSHINE KEEP HEAD COVERED. WEAR SUN GLASSES, KEEP SHOULDERS AND LEGS COVERED. GO AT A SUN TAN GRADUALLY.

TAKE IT EASY ON WALKS IN HOT SUN. REST, NOW AND THEN, IN THE SHADE.





IT'S SNOWING! WHO WANT'S TO STAY INDOORS! PLAN AHEAD TO COME TO SNOW-DAY MEETINGS IN SNOW OR SKI SUITS AND BOOTS.

PLAN FOR EXTRA MITTENS, OR WEAR WATER REPELLENT ONES, FOR BUILDING SNOWMEN OR SNOWBALLS.

WHEN BICYCLING – WEAR SLACKS SHORT, ROLLED OR CLIPPED. KEEP KNEES AND SHOULDERS COVERED IN HOT SUN. KEEP HAIR AND SCARVES FROM BLOWING IN EYES. SUN GLASSES HELP, TOO.

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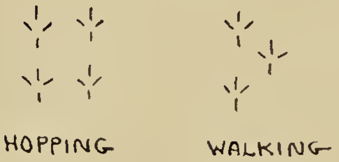
ALL THIS NATURE — JUST FOR THE LOOKING!

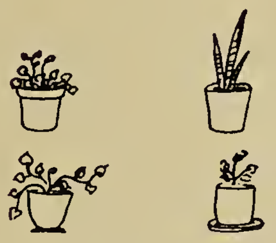
YOU DON'T NEED TO KNOW EVERYTHING TO ENJOY NATURE.

SEE HOW MANY SHAPES OF LEAVES YOU CAN FIND.

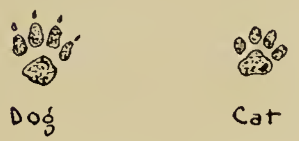
PICK OUT ANY GROUP OF STARS AND WATCH HOW THEY MOVE FROM MONTH TO MONTH.

DOES THAT BIRD WALK OR HOP? THE TRACKS WILL TELL YOU.





HOW MANY DIFFERENT LOOKING HOUSE PLANTS CAN YOU FIND?

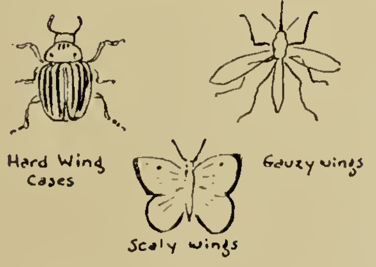


LEARN TO TELL THESE FOOTPRINTS APART.

LET A DOG OR CAT WALK ACROSS A SHALLOW PAN OF MOIST SAND.

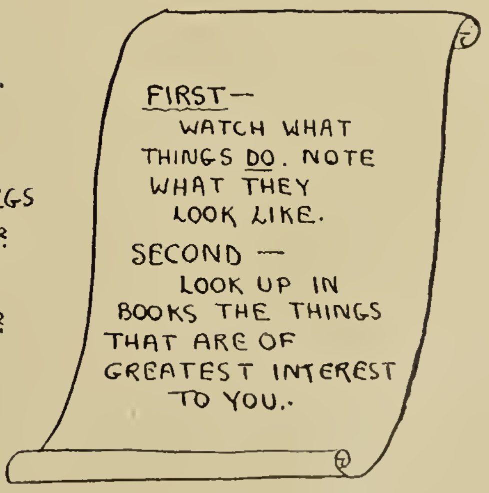
DOES A HORSE HAVE EYELASHES? WHAT COLOR ARE THE EYES?

INSECT WINGS



ANY OTHERS?
HOW MANY LEGS?
ALL INSECTS HAVE 6.
(your'e welcome!)

ARE ALL BIRDS' LEGS THE SAME COLOR? HOW ABOUT A PIGEON'S LEGS?



FIRST— WATCH WHAT THINGS DO. NOTE WHAT THEY LOOK LIKE.

SECOND — LOOK UP IN BOOKS THE THINGS THAT ARE OF GREATEST INTEREST TO YOU.

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out all fires with water or dirt. A real woodsman or walker realizes that others will follow in his steps and does not pick flowers or cut shrubs or ferns along the trail. His name never appears on a tree's bark. And wherever he goes there is fun and laughter, but not of a crudé or noisy sort that may be disturbing to others.

The enthusiasm, interest, and sportsmanship of the leader are of prime importance. As he leads, so the children will follow in these respects. If the leader permits the children to help in determining the goal and route to take, arranging for announcements, planning for and obtaining fire permits and necessary equipment such as nets, cooking outfits and food, they will feel they are sharing more in the enterprise. Lecturing on nature en route is not very successful. Asking intelligent questions to which the children can discover the answers is a far better way of arousing interest. A list made out in advance of the things you might find or which you want to find, will keep everyone on the alert.

Knowing places to look is an important part of a field trip. Look under stones, on rotted logs, on the bark of trees, in the bottom of pools and under damp leaves to discover many insects and other animals ordinarily out of sight. Examine closely liverworts, mosses and fungi usually overlooked.

Have a definite objective for the trip. The world of nature is far too comprehensive to try to absorb all at once, so limit the field of your interests. This can be done by selecting a specific kind of habitat such as the beach, marsh, or lake to explore, or by emphasizing certain themes on general walks.

PLACES TO GO

Hills, Mountains and Woods provide acquaintance with trees, flowers, and ferns. Notice the structure of these plants and how they are adapted to their surroundings. Read the life story of a tree in a tree stump. You can read the story of the formation of the earth's surface in the hills and valleys and in the outcroppings of rocks. Walk softly, listen and watch for birds. Which ones frequent tree tops? Which forage on the ground? Play tracking and trailing games.

Meadows, Fields and Roadsides. You will find many insects here for your collection. How are plants suited to open sunny ground? Meadow and field plants are usually present in abundance and can satisfy the bouquet-picking urges of children or provide material for a collection of flowers or grasses. Have you ever seen grass in bloom? Look closely in the spring or early summer. Are there meadow mice runways in the grass? Find a gopher hole—and a gopher coming out!

Streams, Lakes and Ponds. Lie flat on your stomach and watch the water life. Look for dragonflies and water plants. What plants are found along the shore? How are lakes formed? What path has the stream cut? Find a waterfall. What part does water have in shaping the land?

Marshes. Take care in exploring marshes —no one wants to be bogged down! Look for bird and animal life. What kinds of plants grow here? How are cattails used? If you find grasses or reeds suitable for weaving mats, collect some to take home.

Beaches. Many new plants will be found on sand dunes near the beaches. How do they protect themselves against dry, desert-like conditions? Are the sand dunes moving? Why? Look at the sand. How was it made? Why are the pebbles round? Collect shells on the beach, examine the tide pools for small animals and seaweeds. Catch a crab and study it. Notice what animals live above the water level, below high tide in the sand, on the rocks. Watch a barnacle feeding. How does a sea anemone feed? A starfish move? Examine the seaweeds. What makes the waves? The tide? What birds do you find on the beach, on the water?

Quarry. Obtain permission before you go to a quarry; then observe the rock formations in the quarry wall and see how many kinds of rocks and minerals you can find. How does man use what he is taking from this quarry? Look for fossils in the rock.

Farms and Dairies. Every city child should visit farms and dairies, for it will be as novel an experience to him as a visit to the zoo. It often takes an outsider to help country children really see what they have been looking at all their lives. Here you can watch and learn about crops, planting, pastures, domestic animals and their care.

IN-TOWN EXCURSIONS

If you are city-dwellers you can take the children on trips to places unknown, and hence exciting, right in your community. At first thought there would seem to be only two or three places to go—a museum, zoo, or park. But if you sit down and survey your community mentally—its stores, industries, factories and the raw materials they use—you will find more places to go than you can ever cover. Yet there is no need to try to cover all of them in any specified time. Keep them in mind and when the occasion is right pull one out as a special and timely event.

NURSERIES AND GREENHOUSES. Perhaps you plan to start gardening. Trips to nurseries and greenhouses, garden sections of department stores, florists, and famous public and private gardens will tell would-be gardeners much about the how, why, what, when and where of cultivating flowers and vegetables.

STORES. Just down the street you will find any number of stores. At the vegetable stand you will find what parts and kinds of plants we eat; at the shoe store, what animal hides are used in shoes and how they are prepared, and at the jewellers, what the various precious stones look like, where they are found and how they are cut. Look in a drug store window and see how much you can learn about medicines—their plant, animal, and mineral sources. There is not a store you can go into which will not have something new and interesting to tell you.

FACTORIES, FOUNDRIES, MILLS, CANNERIES, AND BAKERIES of all kinds will show you how man makes use of natural products. Perhaps you can see how pig iron or steel is made, how lumber is cut, or how paper is made from rags or pulp. How do they preserve our food in cans and how is bread made? Watch a boy's eye and listen to his questions. You will take him again!

CITY PARKS AND STREETS. A walk through city parks can reveal many of the forms of life seen on trips to country regions. A surprising number of birds may be found even in the heart of the city, wherever there are a few trees and some grass. In city streets there are trees and flowers and birds, dogs, cats and horses to notice.

MUSEUMS. Go to the museum armed with several questions to be answered, questions which have arisen in the nature activities. If the children are eager to track down a certain rock or to discover the colour of the eggs of a robin whose nest they found, or to find out whether the bat which flew past on the return of a hike has fur or feathers, the trip is more exciting than if the children wander purposelessly through rooms and rooms of cases.

Planetariums or observatories, botanical gardens, fish markets, fur shops, pigeon lofts, pet shops, flower shows, animal hospitals, will all provide exciting trips. But remember, wherever you go it is best to ask permission in advance and make arrangements to take the trip when the proprietor, employee, or museum leader will be there to answer questions and show you about. Some people are a little dazed when fifteen or twenty-five children descend on them unexpectedly!

Explorations and How to Record Them

BETTY PRICE

It is a problem to know how to simplify the world of nature enough so that you and the children are not overwhelmed by the vast number of opportunities. One of the ways to achieve this end is to mark off a small section of the world and explore it thoroughly. This is what making a survey involves.

The exploration may involve a "grass-root jungle" in a square foot of lawn or vacant lot; it may cover ten square yards of roadside meadow, swamp, or pond (water and all); it may be a safari around a city block or thorough combing of a camp site, playground, city park, or even a whole community. It may be planned on a moment's notice and take a few minutes or an hour, or it may be a carefully thought-out study with plans for a complete survey taking days, weeks, or months to complete. The group and the opportunities will determine which it shall be.

The findings of the explorers may be handled in various ways. If you are exploring a "grass-root jungle" or another small area, each explorer may report his discoveries as he makes them, or after the search is over. There will be reports on the plants, insects and rocks that are found. Are they native or imported? Are the insects harmful or beneficial to the plants? Find out what is interesting or peculiar to each kind. For the larger areas of camp, playground, park, city block, or community, the findings may be given in these or any one of the following ways.

Maps are fun to make and can tell a very clear story of your adventure. Each child may make one or the group may work on it as a whole. Besides the experience in exploring, of looking up unknown trees and ferns and rocks, the survey which ends in map making brings in the use of a compass, estimating or pacing distances, and the study, reading, and making of maps.

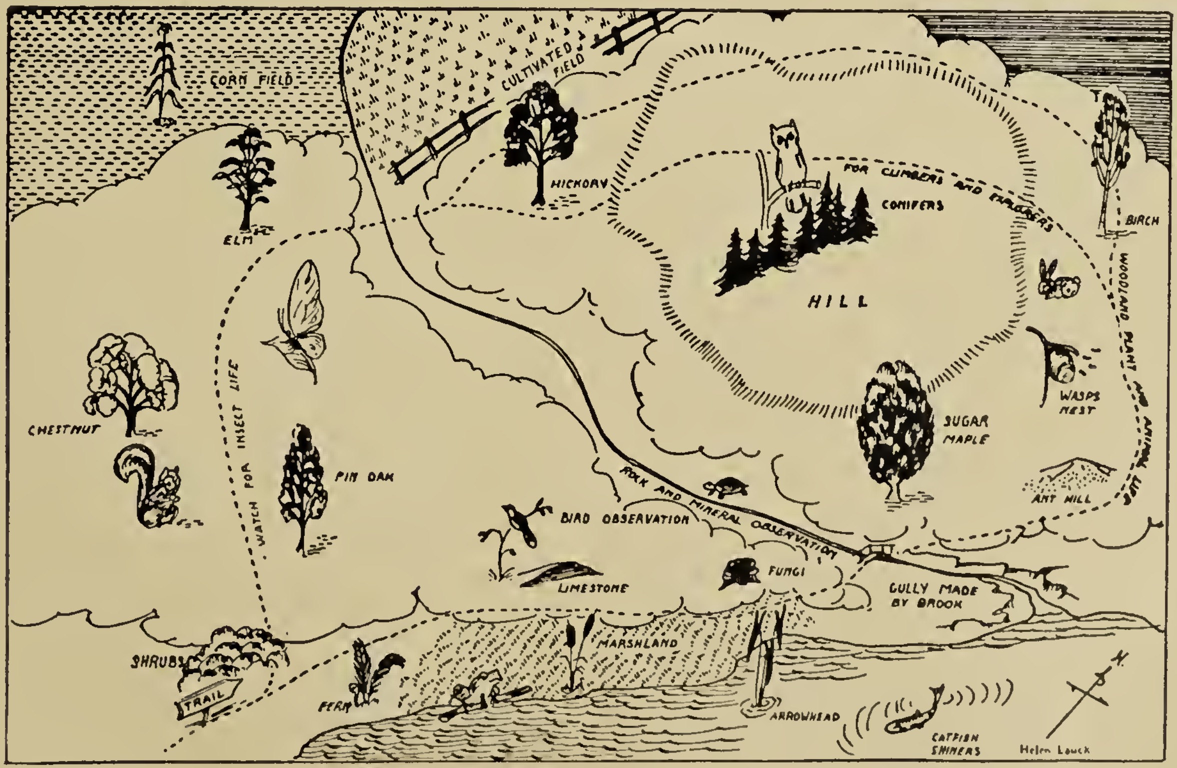
The map may attempt to portray every thing important that is found, or it may be limited to birds, trees, flowers, or any one aspect of nature in which the survey specialized. Maps for cities do not differ basically from maps of camp or woods. You might map a city park, or a few city blocks for trees and types of building stone, and then mark gardens, yards or stores in which some interesting object is to be found. Or you may indicate on a map of the city the outstanding places in interest to nature groups, such as museums, zoos, parks, and bird sanctuaries.

In making a wall map, lay out the area on a large scale on a piece of wrapping paper, oilcloth, or an old white window shade. Use regular map symbols (see a Geological Survey map) for indicating trees, marshes, fences, houses and the like, or make it a "romance" map with pictures of what you find sketched in the proper place. If there is not room to portray all the "finds", leave a wide margin around the edge and draw the pictures or write the names there, running strings or lines from them to the place on the map where they were found. Colouring the map will make it more attractive.

Relief maps of your area are more realistic than the wall maps, and they are easy to make. Tear up a lot of newspapers into small pieces about an inch square. Soak them in hot water for several hours, then stir and knead them until they make a grey clay-like mass. Squeeze out the water and mix the mash with soft library paste. Now you are ready to lay out the map (to scale, of course) on a board, using the paper mash. When the map is dry, enamel it and then add such features as you wish—roads, fields, woods—in colour or in black india ink. You can make small models of trees, shrubs, and houses to glue on the map, if you like. Another type of relief may be made by piling up strips of corrugated cardboard, one or more for each level, and then pouring plaster of Paris over it or applying a thin layer of papier-mache—the newspaper pulp.

CHARTS

Charts may be simple lists of the objects found in the survey—lists of birds, trees, flowers, and insects. They may be made more interesting and valuable by adding sketches, pictures, mounted specimens, leaf or blue prints, or diagrams of the parts of a flower and types of leaf forms and venation. Make a chart in red of flowers which should never be picked, in yellow for those that may be picked in small numbers, and in green for those that may be picked freely. You might also list the organizations promoting nature activities, such as the Girl Guides, Boy Scouts, Garden and Hiking Clubs, Audubon Junior Clubs, Museums, and so on, and call on them to help you with your programme.



CHECK LISTS

Make a list of the birds, trees, flowers, ferns or insects which you find in your chosen area. As you discover or identify additional species, add them to the list. Check lists for trees and insects need not be seasonal, but birds require a special type of list.

The name of the bird is at the left, with a check after its name in the column which indicates whether it stays all year, (resident), appears in the area only in summer (summer visitant), or winter (winter visitant), or merely flies through in the spring or fall migration, staying only a day or so (transient), or is seen only occasionally and at any season in the area (vagrant).

Check lists may be used to record the kinds of birds or trees or flowers there are in your area and which ones you know. In the case of birds, the list suggests also the study of migration. In one community, check lists of the birds and other animals on the route of a favourite hike have been made and are used by the Boy Scouts and all the playgrounds, each group checking those on the list seen on various trips.

KEYS AND OBSERVATION GUIDES

A key is a printed or mimeographed outline designed as an aid to identification. Good field books in the various divisions of nature often have keys to aid the users of the books in identifying objects. Keys are made for identifying birds, trees, flowers, ferns, rocks, insects. Any student of nature will want to learn how to use these already prepared keys. However, homemade, much simplified, keys may be made by the older children of a playground, camp, park or community centre to include only those objects of interest in the immediate neighbourhood; and in the making of these keys a great deal will be learned by the makers. The completed keys will be used by both the younger and older children interested in learning about them. It is a good idea to obtain the help of a local naturalist, science teacher or nature hobbyist, for the keys need to be scientifically accurate. Once made, a key may be shared with other groups. In one city, keys to birds on a lake are used by the Girl Guides, by playground groups and by the schools. Each child or a small group is given a key to work out.

The basic principles in making these keys, which are referred to here, are the same for all. Keep them in mind and make up your own intriguingly interesting keys.

There is a reason for choosing a small area and a specific topic for these keys, for if you tried to key all the birds or flowers or trees in a large wooded area or in a community, one key would be too technical for the children's use. Choose an area small enough so that the number of species keyed is small, and you must key all the common species in the area. Date the keys for birds, and perhaps for flowers and insects, for these are apt to change by seasons. A key to birds at your feeding table or at a lake in winter would not fit it in summer.

When you have selected an area and have chosen one aspect to key, such as birds, water life, trees, weeds or ferns, list every species of your chosen topic. This is where you may need the help of a specialist. Then decide which is the best way to group them.

Trees may be divided into two groups: deciduous—those which lose their leaves in winter—and evergreen trees. Evergreen trees may be divided into needle or scale-leaved trees, and the broad-leaved ones into those with simple or compound leaves.

Then redivide these divisions again and again until your particular tree is reached. When you have the trees divided, decide on the most outstanding and conspicuous characteristic of each tree that sets it off from every other species in the group. You can use the size, shape or arrangement of leaves, flowers, or fruit.

Flowers may be grouped by colour. Then the size, shape or striking peculiarities of the flower, leaves or plant may be drawn upon. Characteristics of the more easily recognized families may be worked out. Everyone should become familiar with the sunflower, violet, pea, mustard, mint, figwort, and lily families. It can be done in a single key.

Birds, too, may be grouped by colour, but a grouping by families is also successful.

As a variation from these more formal keys, you might try making a mimeographed observation guide to the exploration of your area. This guide, like a puzzle or a treasure hunt, will give clues, and the user will have the fun of ferreting out the answers himself, answers which will reveal the names of birds, trees, flowers, ferns or animals he sees. You may make your usual key, but after the species has been keyed out, ask a few questions that call for close observation of colour, form or behaviour, adding what information is helpful. Leave space for answers and sketches. Make these guides lively and intriguing.

Collections and Exhibits

BETTY PRICE

INVESTIGATE the contents of any boy's pockets and you will see that the collecting urge is a universal one. There is a period (about twelve) when some children are particularly interested in nature collections. They should be allowed to make them—with guidance.

The collections may be group collections, such as collections for the nature museum, or they may be individual collections. It may be well to start group collections first, encouraging only those who show special interest in some phase to go on with an individual collection. In this way an interest in conservation is developed, the making and organizing of collections may be guided, and the interest of the group may be kept alive.

NATURE MUSEUMS

Your nature museum may consist of only two orange boxes, one on top of the other. It may be a table along a wall, with shelves, beaverboard, or heavy corrugated cardboard above it for additional display. It may be an old bookcase, the whole corner of a room, or possibly a whole room set aside for collections, pets, displays, and experiments. At camp the museum may be indoors, or outdoors in a woodsy spot with rustic tables, shelves, and sheltered boxes for objects which rain would injure; or it may be a rustic lean-to.

A museum can be a vital, absorbing part of the nature programme or it can be a morgue of dried, dusty, or dead specimens in which children show only a fleeting interest, if any at all. It all depends on how you develop the programme. So plan it with care, and let it be more a workshop than a cut and dried museum.

Make the programme a *doing* one. Children are much more interested in nature when they are making cages, caring for pets, mounting insects, arranging displays, publishing a newspaper, writing a note for the bulletin board, or experimenting with seed germination, than they are in merely staring at objects laid in a row. Let the children build the museum; let them run it. Those especially interested in the museum may be appointed temporary or permanent "curators" and may have charge of special divisions such as pets, collections, the bulletin board, or reference library. Or children may be appointed curators of smaller units such as insect collections, leaf collections, posters, the aquarium, or some specific museum pet. A badge or pin (made in craft period) or other insignia of membership appeals to many children.

You will find that things that are alive, that grow and move and jump, have a far greater drawing power than dead, immovable things. See to it that as many live animals and plants as can be properly cared for join the museum exhibits. Children should look after the animals and plants; the feeling of responsibility and ownership will do much toward developing consideration in handling wild life.

And to make live things more alive and dead things live, make your displays and collections tell a story—show some exciting fact. You *can* press a hundred leaves or collect a thousand insects and two dozen rocks and label them, and you've done something, it is true. But how much more interesting and meaningful it is if the leaves are organized into smaller, more significant displays of leaf types—of local oaks, for instance; if the insect collections show the life cycle of a butterfly or those insects harmful and beneficial to man; if the rock exhibits show how mountains are formed and what stones are used for building in the city!

A label on an object or exhibit can work wonders in capturing interest, arousing curiosity, or making the reader think. Such labels are not just statements of the Latin or even the common names. They point out an interesting fact or ask a question and give the common name in an incidental fashion, such as, "It is plain to see why this insect is called 'Walking Stick'." The labels should be short, informal and chatty. They may be printed in India ink on sturdy cardboard and thumb-tacked to hanging displays, or they can be set in grooves in small blocks of wood. The users of the museum can read the label more easily if it slants backwards slightly in the block. Change the labels frequently so that they are never taken for granted. A new label on an old display can point out other facts of interest. Changing the colour of labels will help to draw attention to fresh wording.

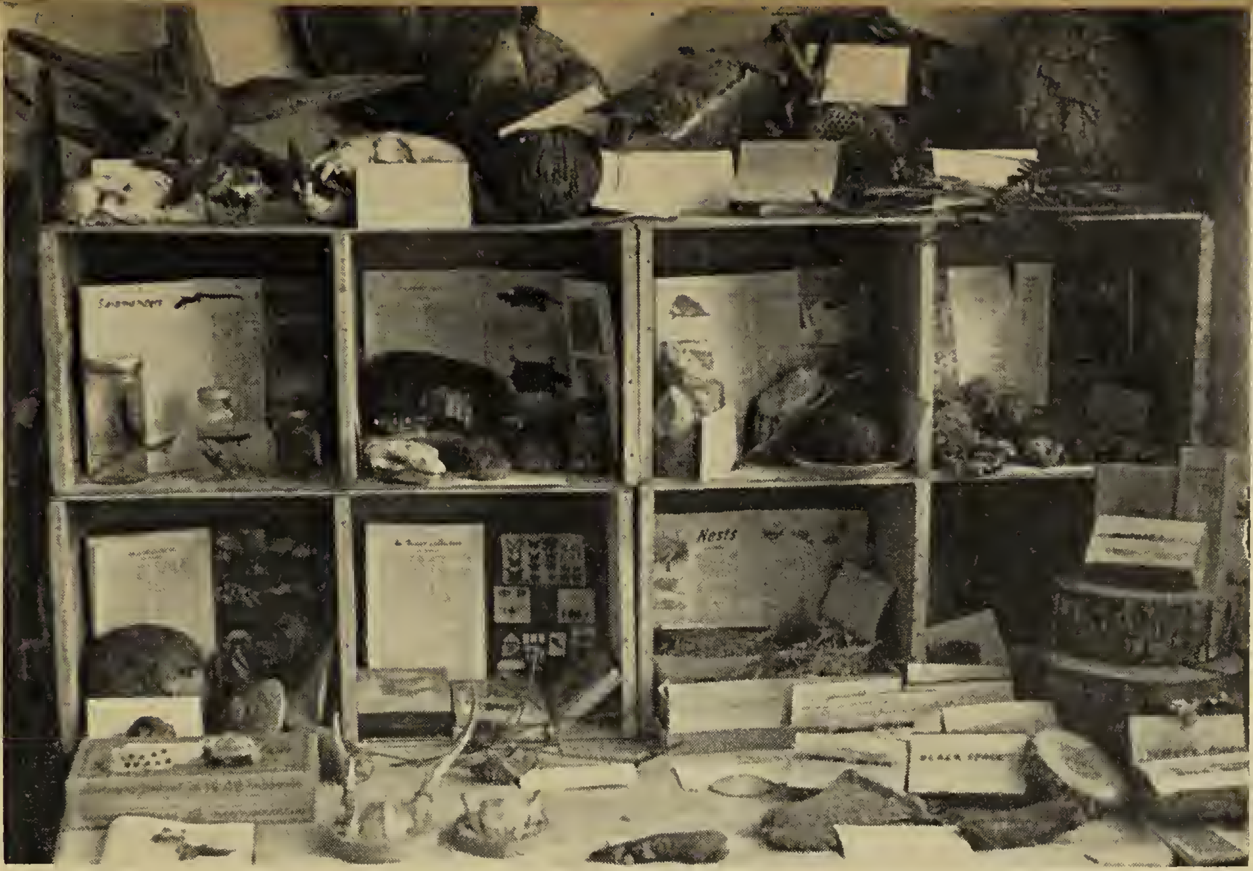
There may not be room for all the displays to be shown at once. This is just as well, for a changing scene is always more interesting than a static one. How few of us ever really *see* the pictures on our walls after they have been hanging a few weeks? So change your exhibits frequently, combining and re-combining your materials, letting the children do it, of course. In camp, or where the group changes periodically, it may be well to destroy many of the exhibits at the end of the season and start afresh next season, for it is the making of the museum rather than the display itself which has most interest and value. Of course rare objects and permanent collections of insects will be kept, and if the group is permanent it is well to keep the displays, providing for variety and progression of topics by re-arranging the displays to tell still other stories.

In order that others may know what is going on in the museum, keep a constantly changing series of notices on the bulletin board. Include reports, drawings and stories by the children.

Set aside a shelf labelled "What Is It?" Put unidentified "finds" here until someone discovers their names. You can also put here objects which you want to draw to the group's attention. As a special event a number of objects may be put on the shelf and points may be given for identification.

FLOWER COLLECTIONS

If you want to make a collection or press certain flowers, write first to the botany department of your provincial university for a list stating which flowers should never be picked, those which may be picked in moderation, and those which may be picked freely. Abide by the list scrupulously, even though a rare flower tempts you greatly. As a general rule it is best to leave woodland ferns and flowers untouched. Flowers and ferns growing in the sun, in fields, meadows, roadsides, marshes or sand dunes, are usually on the "permissible" list. So confine your collections largely to these. "Never pick one unless ten are in sight" is a good rule for amateur collectors, no matter what kind of flower or fern it is.



Canadian Nature may be worked into the nature corner or school museum, taking the place of labels. For instance, as part of the teacher training programme in the Normal School at Fredericton, N.B., a demonstration rural school was conducted for the benefit of student teachers. The nature museum was set up in four orange crates, arranged on a table as shown in the photograph. In each section of the crates is a copy of *Canadian Nature*, open at a topic relating to the specimens on display. On the window sill were arranged bird houses, and three articles on attracting birds. A copy of the magazine was open under two blueprints of maple leaves, and other copies were arranged with the references in the room. The display demonstrates some of the many ways in which *Canadian Nature* can be used, and shows how instructive a simple nature museum can be. Such a project could be set up easily in any school, and the exhibits changed from time to time in order to maintain the interest of the students.

Here are happy, interested children, learning because they like to learn, and learning by doing. To set up and maintain a balanced aquarium is to acquire an understanding of the complex inter-relationships which exist throughout the world of nature. Such an understanding leads to sound conservation attitudes which are necessary to the social and economic welfare of Canada.

Carry the flowers you do collect for mounting in moist, rolled newspaper, or put them in a flower press as you pick them. A flower press is simple and inexpensive to make, for it consists of two sets of slats from half-an-inch to an inch thick fastened together with cross pieces. Straps or heavy cord fasten the two sides of the press together. You may make the press any size, but an outside measurement of 10″ x 12″ or 15″ x 18″ is convenient. Cut five or six pieces of heavy cardboard or corrugated cardboard the size of the frame. Fold newspapers to fit. Lay the flowers between the newspapers, piling the papers one on top of the other, and placing blotters, if you can get them, between the folded newspapers to absorb moisture. Slip in a cardboard at intervals to keep the pile level and to let in air, for the flowers must be dried as quickly as possible. Tighten the straps for pressing. Change the newspapers after a day or so, especially if you have juicy-stemmed plants. By placing the flowers in papers and laying a board on top with bricks or books on it, you can press the flowers quite effectively.

Use heavy paper for mounting, cutting the pieces all one size. The dried flower may be laid on the paper and fastened to it with transparent gummed paper or adhesive tape. A neater, more attractive way, however, is to lay the flower on a sheet of glass spread with a mixture of glue and vinegar (equal parts of each), and then to lay the flower on the paper, pressing carefully. The label should include the name of the plant, where, when and by whom it was found.

Because of the multitude of flowers to be had—and you need seek no farther than a neighbour's yard or a vacant lot for scores—and because of the expense of satisfactory mounting paper, it may be advisable to limit the collection to one group. Such a collection has meaning when it is set up to show tree flowers, types of grasses, local "weeds", domestic flowers of the neighbourhood, or flowers which grow together in different kinds of places, such as those found in swamps, along roadsides, in fields, in deserts, or in sand dunes. If you are prepared to help the children do it, a display of flower families, with the labels, emphasizing family differences, can be an adventure in geneology which will set children to examining flowers in search of family ties.

LEAF COLLECTIONS

Suggest that the children bring old magazines on the next hike and slip leaves into them for a leaf collection as they go along. In case the children may not be able to remember the name of a tree from its leaf alone, let them write the name of the tree (if it is known) on the margin of the page with the leaf. Use a flower press for the leaves if you have made one.

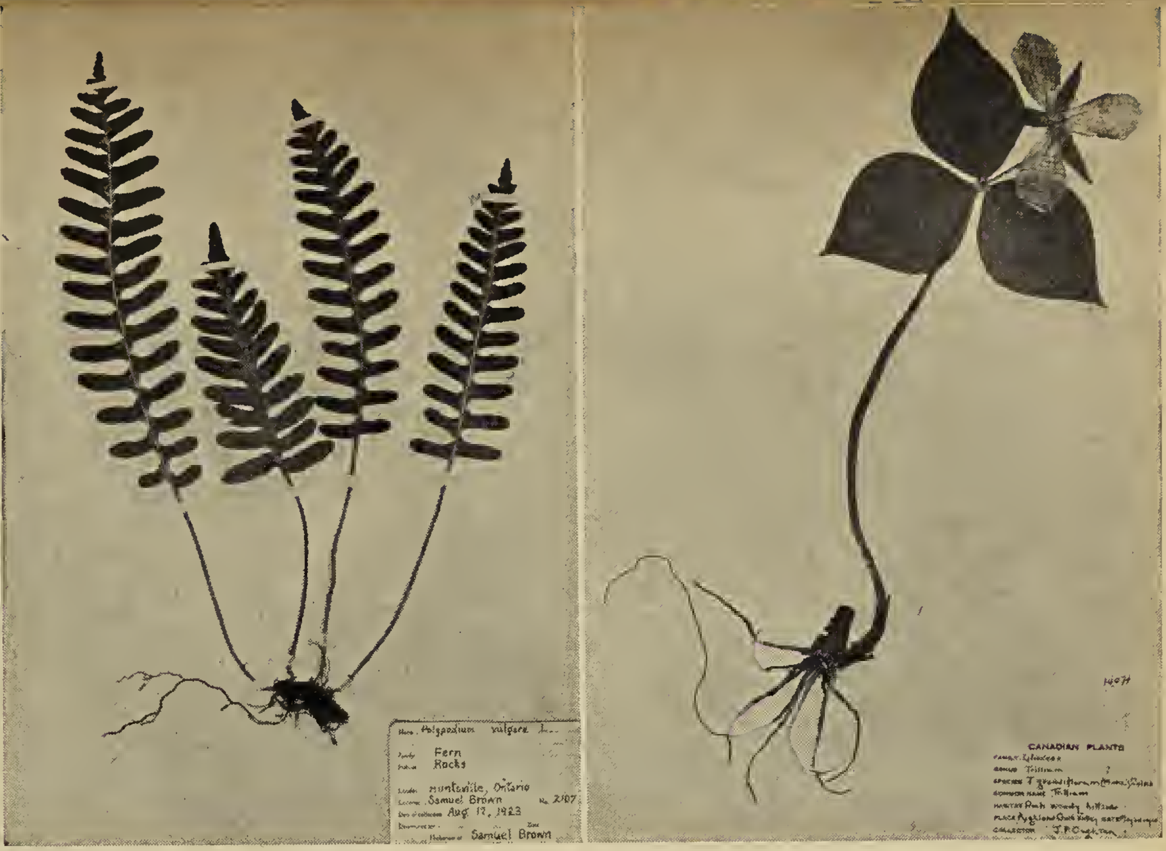
When the hike is over and you have returned to your headquarters, open the magazine or press and make sure the leaves are smooth and aren't all bunched in the centre of the page or newspaper, making a large bump. Spread them out, some near the top edges of the press, some near the bottom or the sides, so that when weight is applied or the press straps tightened, the pressure is even and the leaves flat. You need at least fifteen to twenty pounds of pressure or weight in order to keep the leaves from wrinkling as they dry. It helps if you dry them as quickly as possible in a warm spot.

To mount leaves, spread a half-and-half mixture of liquid glue and vinegar on a glass. Place the leaf on the glass and press it gently. Pick up the leaf and lay it on a piece of manila tag or heavy mounting paper. Press it down carefully. This is the best method to use, but there are other satisfactory ways. One is to spot the back of the leaf with glue and paste it to the paper; another is to attach the leaf to the paper with narrow strips of transparent gummed paper or adhesive tape, running across the stem and tip.

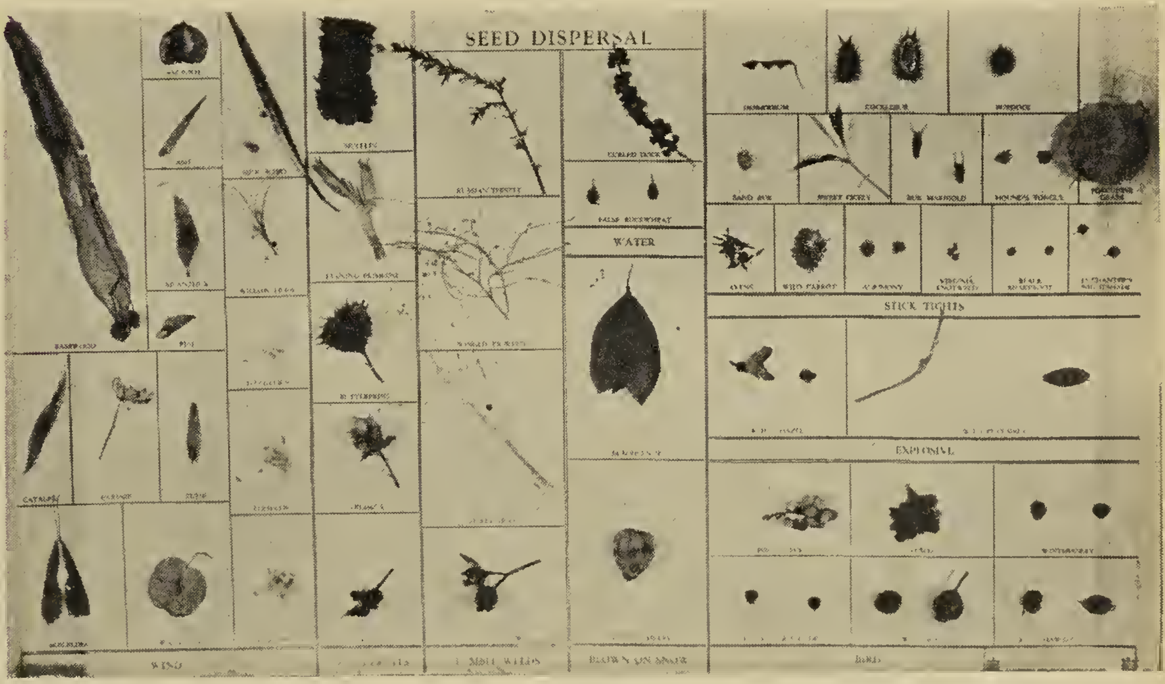
Leaves may be arranged to show local oaks, pines or maples, or to show examples of trees with broad leaves, scale leaves, or needle leaves. They may also be divided into two groups—leaves of deciduous trees, which lose their leaves in winter, and evergreen trees. Shapes, margins, and venation may be the basis of organizing a collection. In the study of leaves do not neglect to consider their food-making function. (Leaves have far more vital purpose than shading a tired hiker!)

WOOD COLLECTIONS

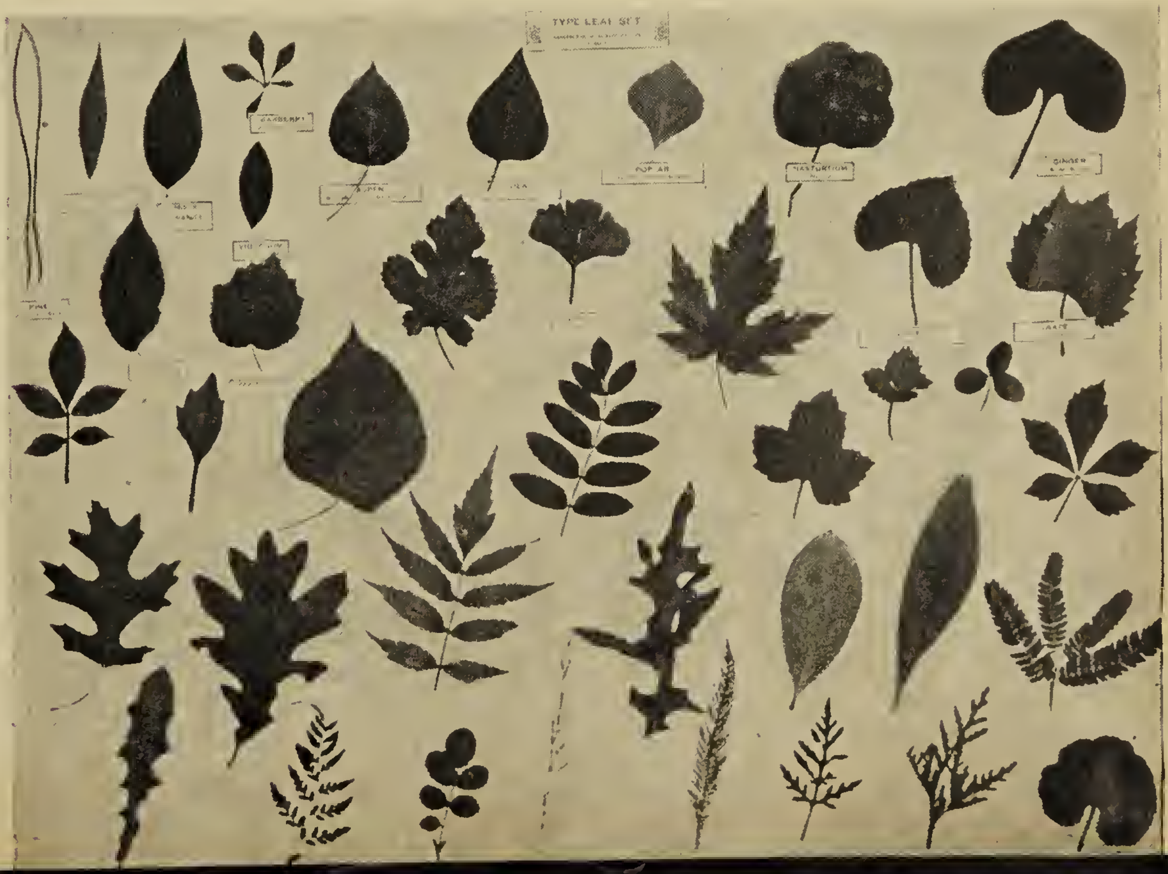
All wood is not alike, as you will realize if you look at the furniture in your home, the bark of trees, or the lumber in a lumber yard. Use wood collections for showing these differences, for helping to identify trees, for



CORRECT METHOD of mounting pressed plants. The root, or cross section of it, should be included. If plant is too tall for sheet, cut it and mount the two portions side by side. Note that some fern fronds are reversed to show sporangia, essential to identification. Labels are important.



SEED DISPERSAL. A neat and orderly collection, classified to tell a story, and clearly labelled, will always arouse interest. Children will enjoy hunting for specimens to fill each labelled section.



LEAF TYPES. This is one of the easiest and most interesting collections to make. From it the various shapes can be learned and adaptations considered. Labels may point out the difference between simple and compound leaves, various types of venation, surfaces, margins, outlines, etc.

considering the many uses of wood by man, and for emphasizing the need of forest conservation. Here are three types of collections to make:

Tree Identification. At camp or in the woods, cut a dead, but not rotted, branch from a tree, choosing a branch about an inch in diameter. (Be sure you have permission to cut it.) Cut a piece five or six inches in length. Saw it half-way across at the middle and then cut from one end to the middle, exposing the pith in the centre. Cut the top of the split end at a 45-degree angle to show the quarter grain. Sandpaper the exposed surfaces and then shellac them. Label with name, place where found, and the date. Cut all the pieces the same size to make the collection neat in appearance.

If live wood must be cut, let the branch dry or "season" before cutting it into short sections so that it will not split while drying. Select live wood only from a large tree or else from a sapling that cannot grow into a useful tree because of overcrowding or injury. In a city, wood may be obtained from wood and coal yards or from the Park Department when it cuts trees.

Finished woods. Use "mill ends" or scraps from the lumber yard for your collection, if you cannot obtain branches. Cut these all the same size. Then sandpaper, shellac, and label them. List the uses of each kind such as "Red Cedar—lead pencils and cedar chests."

Tree cross sections. Try to get a section of a tree trunk from a wood and coal yard, from the Park Department, or from someone who has recently cut a tree. A convenient size is four to twelve inches thick and ten to thirty inches in diameter. Select a section which is solid in the centre and preferably from a local tree growing on a dry hillside or woodland, for trees growing in dry locations show the annual rings most clearly. A cross section that shows injuries, knots, and work of insects is more interesting than a perfect one.

To prepare the section for display, sandpaper the cut surfaces and then shellac them. Label the section by writing directly on the wood, by pinning cards on the wood, or by placing sets of cards near by and running strings to the spots described.

Count the rings, beginning with the outside one which is the most recent year's growth. Mark ten-year intervals and indicate the date of the first year's growth. Indicate the following: outer bark, inner bark, cambium layer (microscopic), sapwood, heartwood, and pith rays.

TWIG COLLECTIONS

Twigs make an interesting winter collection. "Just a dry old stick," you say. It might seem so, but there's a whole nature project in learning to read twigs. Trees can be identified by twigs alone; the amount of growth in a year can be determined, and much can be learned about branches and buds. This is a fascinating study.

To begin your twig collection, cut twig tips about eight inches long, making sure that each one is alive and that the buds are in good condition. Cut the twig at an angle so that the shape of the pith may be seen clearly from the side. Mount the twigs in shallow boxes filled with cotton and topped with cellophane, or sew or wire them to a corrugated cardboard chart. Label them carefully. It is well to tag the twigs as you collect them, since once at home you may be unable to recall the tree from the twig alone.

SEEDS

Late summer and fall are the times to work hardest on your seed collection, for it is then that most plants mature. Stick some old envelopes in your pocket if you're going on a hike or a walk, and vie with the children in discovering plant seeds and their frequently ingeniously contrived seed pods or containers.

It is not necessary to go far afield for seeds; visit vacant lots for weed seeds, the markets for nuts and fruits, and a florist or department store for seeds of familiar fruits and vegetables. Glue the smaller seeds on a chart, or sew on the larger ones, showing the ways in which seeds are scattered. Put cultivated flower and vegetable seeds in cellophane packets, vials, or pill boxes covered with cellophane, or set stalks with seed pods in jars on a shelf. Extra seeds or seed containers such as cones, nuts, and so on, may be kept for making Christmas tree ornaments or party favours.

INSECT COLLECTIONS

Insects may be collected, mounted, and so arranged that they tell a number of stories. "Insects of the house" might include ants, flies, clothes moths and, alas, roaches! You can show an insect life history, such as the Monarch Butterfly (or any one you find), by mounting eggs (if you are lucky enough to find them), caterpillar, chrysalid and adult butterfly. You might make a collection of insects harmful to man and one of insects useful to man. In an ordinary general collection you will divide the insects into orders, for you will naturally put together the bees and wasps, moths and butterflies, and beetles. Look up the general groupings of insects in order to place the other insects you find. Mount each insect with a sketch, print, or specimen of the plant or animal on which it feeds.

You will need a net for collecting insects. It is a simple and inexpensive matter to make one. Using heavy wire (size ten if you have to buy it), make a loop ten to twelve inches in diameter and fasten it to the end of a three-foot stock—bamboo or a broom handle is satisfactory. If you bore holes three inches from the end on one side of the pole and four inches from the same end on the other side, the ends of the wire may be bent and inserted in them. Then you may wrap the wires with tape, wire, or cord to make a sturdy fastening. Sew to the loop a mosquito netting—green if you can get it—or a net curtain bag, making it square at the bottom and at least twice the diameter of the loop in length. If you sew binding tape or a strip of cloth over the net and wire loop, your net will last very much longer.

Mayonnaise or pint mason jars with screw tops make good insecticide jars, for they have wide mouths and tight caps. The safest killing medium is carbon tetrachloride, obtainable at drug stores. Place cotton in the bottom of the jar, pour a spoonful or two of carbon tetrachloride on the cotton, and fit a disc of perforated paper over it so insects will not become entangled in the cotton. Another method is to pour a quarter-inch of plaster of Paris in the jar, and when it is set, add the fluid. In both of these jars it will be necessary to add more fluid every few days because it evaporates. Insects should be left in the jar some time after they appear to be dead, otherwise they may revive. It is disconcerting when a "dead" insect comes to life!

Cyanide of potassium jars are the most effective killing bottles; but cyanide is a deadly poison, and the jars should never be made or used by children without close supervision. To make a cyanide jar, put a spoonful of cyanide (obtainable at drug stores) in the bottom, cover with sawdust or cotton and then pour in a quarter of an inch of plaster of Paris. Keep your head away from the jar, for the fumes are poisonous. The odour will warn you. When the plaster is set, close the jar.

To make a spreading board, nail two sandpapered pieces of soft wood—about ¾ x 3 x12 inches—into a strip of corrugated cardboard (smooth on two sides), leaving a quarter of an inch between the two boards. Make another board with the strips half an inch apart for stouter-bodied insects. These boards will be used to dry certain insects in their standard positions.

Cigar boxes make excellent cases for insects. Clean off the paper covering, sandpaper and stain the boxes. Line the bottoms with cork, if you can get it, or corrugated cardboard covered with white paper. Put in camphor or napthaline flakes to keep out pests.

Refer to any good science book for instructions for mounting insects.

Expensive Riker's mounts may be imitated by using shallow cardboard boxes. Cut a window in the top cover of each, allowing a quarter-inch margin around the edge. Cellophane or glass may be fastened in with passe partout tape. Fill the box with cotton batting and lay the insect or insects with their labels on the cotton. Put camphor or naphthalene flakes in to keep out pests, and seal the box with tape or fasten it with pins. The pressure of the cotton against glass or cellophane will keep the specimens from shifting their positions. If the cellophane wrinkles in pasting it on, rub a damp cloth over it. This will make it shrink and be as smooth as glass.

When butterflies, dragonflies, and similar insects are to be mounted eventually in cotton, do not use the spreading boards. Turn each insect on its back, impale it through the thorax on cardboard, and spread the wings. Remove the thorax pin and let the insect dry. Then pick it up gently by the thorax with tweezers and lay it on the cotton without pins.

Six per cent formalin or 85 per cent alcohol can be used to preserve soft-bodied insects—maggots and caterpillars for example.

If the body is very fat, make minute incisions in the skin so that fluid may seep in before deterioration sets in. If the fluid becomes yellowish, renew the solution. Small vials or jars can be used for these specimens. Seal the jars carefully with wax, glue or paint.

NATURE SCRAPBOOKS

Nature scrapbooks can degenerate into one of the least valuable of the types of collections, for they all too often contain only pictures cut from magazines and seed catalogues. Collections of blue prints, ink prints, and spatter prints have more value, especially if each one has a small note telling the important thing to notice about the subject. Sketches made in the field are even more valuable. Get the camera club to make a nature notebook or hold an exhibit of nature pictures. As in other collections, make the pictures in the scrapbook tell a significant story. Include poetry, handicraft, or arts and crafts suggestions, or keep a log of all your nature activities.

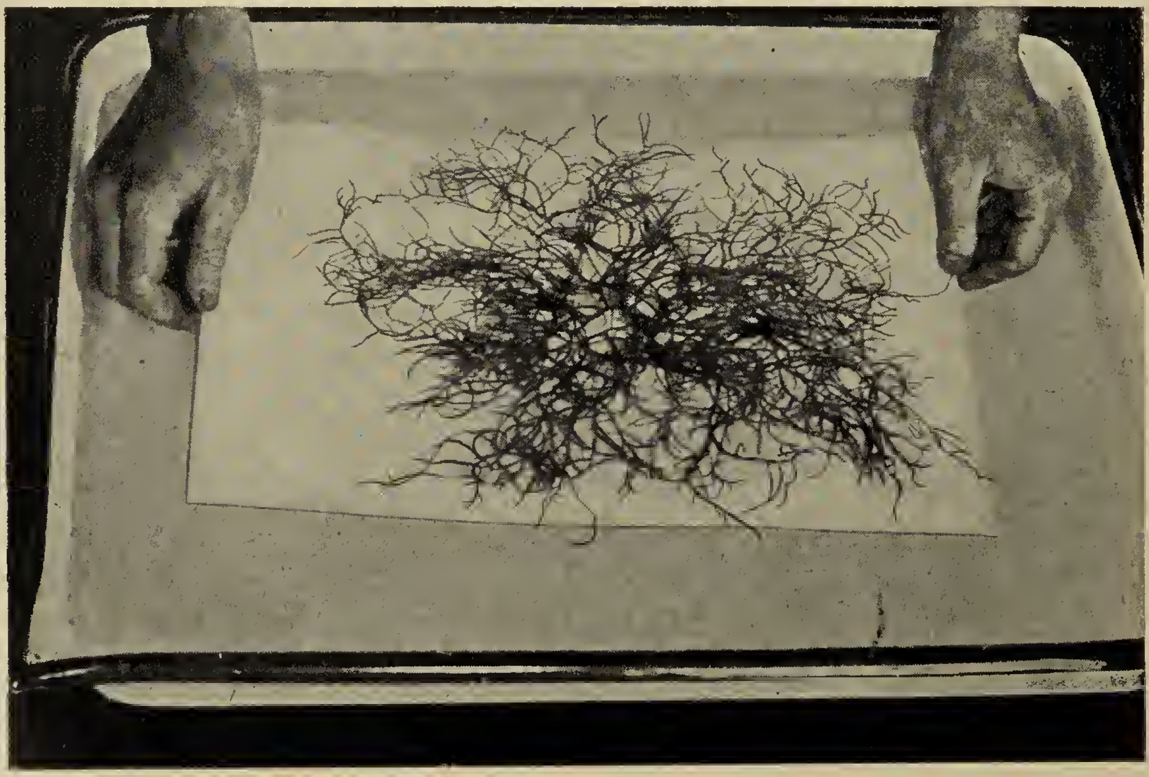
SEAWEEDS

Place a spray of one of the finer seaweeds in a wash basin or a flat open dish of water. Push under the spray a piece of paper (heavy writing paper or paper resembling college biology drawing paper) of appropriate size, and with a long pin arrange the spray on the paper. (Cardboard is too heavy for use.) Then lift out paper and all, retaining as much water as possible to help float out freely all the delicate parts. When they are spread out, drain off the water. If a few spots are still not properly spread, add a drop or two of water with a medicine dropper at these spots and spread with the long pin or dissecting needle (needle stuck head first in a pencil-like stick). Cover the seaweed with a very coarse gauze, place it between blotters and dry as rapidly as possible—a matter of a few days usually, or only a few hours, if the seaweed is very thin and delicate. When the paper and plant are bone dry, remove them from the press and pull off the gauze cautiously. The seaweed will stick to the mounting paper with its own natural glue. If blotters were applied directly to the seaweed it would be stuck to them, too. The gauze peels off.

The Coraline algae are stiff and do not seem to produce any glue. Dry these between blotters and then glue to a mount with liquid glue. Seaweeds too large and thick to be mounted on cards can be soaked twenty-four hours in water and twenty-five per cent glycerine, and then hung out on a clothesline to dry.

SHELLS

"Down on the beach when the tide is out
Beautiful things lie all about . . ."



Some of these are shells. Collect these and place them in individual or partitioned boxes or set them on shelves. One small museum has put sandpaper on the shelves under the collection and a paper sea gull on the blue wall above them, making a "beach" of the display. The shells may be arranged by families or they may be arranged to show where the animal which was once in the shell normally lived—above the high tide mark, on beach and rocks uncovered at low tide, or below the low tide mark. Extra shells may also be collected and made into buttons, necklaces, Christmas tree ornaments, and winter dish gardens.

ROCKS AND MINERALS

Since uniformity adds to the attractiveness of a collection, choose or break the specimens nearly the same size. Make a plaster of Paris base and imbed the specimen in it. Paint a spot of white enamel on each rock or mineral, and when it is dry put a number on it in India ink. This number can be keyed out on a card telling the name and source of the rock. A chart of the uses made of the rocks and minerals, or the listing by types according to the way they were made (igneous, sedimentary or metamorphic) will make the collection tell a story.

Nature in Arts and Handicrafts

BETTY PRICE

Let part of your nature programme overlap the arts and crafts. The world of nature will provide many materials for you to use, materials which will cost less than those you buy, and at the same time will allow you to share the experience of the Indians, early settlers, and those who depended directly on nature for their supplies before the days of C.O.D. and mail-order houses. Use the pine needles at hand for your baskets, the clay from a near-by pit for clay modelling, local wood for carving spoons, buckles and buttons, attractive stones for jewellery. Carve bone rather than celluloid. Use dyes from wild wood plants instead of commercial dyes.

In designing your articles turn, not to a book of designs but to nature, as the Indians and pioneers did. Trees, leaves, ferns, insects, birds and other animals, stars, rocks—everything you see will suggest motifs and colour for your designs. Use them as they are, or conventionalize them if you prefer. Although a small child's design may sometimes seem crude to you, it is his own and will be much more satisfying and valuable to him than one you might suggest. Encourage originality and creativeness. Use these designs in your block printing, metal work, and leather tooling.

Let some of your field trips be sketching or painting trips. Sketch or paint in the field; or on a rainy day sketch pet animals and near-by trees, or paint living flowers. Copying drawings and pictures has little meaning or value. Make "from life", your guiding principle in all such activities.

BLUE PRINTS

Blue prints are as much fun as magic. Presto! and something yellowish white turns a bright blue, and the impression of fern, leaf, flower, or grass is permanently caught for a collection. Paste the stars of major constellations in their proper relationship on a piece of glass, or ink them on cellophane and then blue print them, and presto again—you have the sky in your lap! A map of a camp or playground, or a page of Indian signs or blazes may be drawn on cellophane and blue printed so that everyone may have copies for his notebook. Blue print silhouettes of flowers, leaves, or grass are far more attractive and meaningful if they are coloured with water colours or crayons. Trim and mount the silhouettes in a booklet or on a chart to tell a story of stars, of camp, or of kinds of flowers and leaves.

The best frames are the regular blue print or printing frames from a photography supply store. You can make the frames yourself, however. Get a sheet of glass at least 5″ x 7″, or an old photographic plate from a photographer. Scrub it clean and cut a piece of corrugated cardboard from a carton

the same size. Tape the edges of the glass; then place on the cardboard and tape one end of the glass and cardboard together. This makes a very cheap, usable frame for your blueprinting activities.

Buy some blue print paper cut in 5″ x 7″ sheets. It is almost impossible to cut it yourself without wasting a great deal, for you need a dark room, and the uncut sheets are difficult to manage. If the kind of paper you buy needs a chemical to "fix" it, it is often sent free, or costs very little extra. A local blue print shop should be able to supply you with paper and chemical.

To begin the blue printing process, lay a pressed (preferably) or fresh flower or leaf on the glass inside the frame. Then place on the flower or leaf a piece of blue print paper taken quickly from a dark box or magazine, sensitive side down. Put the cardboard back down and hold together firmly, pressing the glass against your chest so as not to expose the paper to the light. Then go outside and expose the paper to the sun, taking care that the plant does not slip and that your head or fingertips do not shadow the print. When the print is sufficiently exposed, return to the table, lift out the paper, then wash and rinse it thoroughly in cold water. To determine the time for exposure cut a piece of paper in four parts and test it by exposing it to the sun, one piece for fifteen, one for thirty, one for forty-five, and one for sixty seconds. Wash them and use the time necessary for the brightest blue for all your prints. Lay it between newspapers to dry. Change the papers now and then to hasten drying.

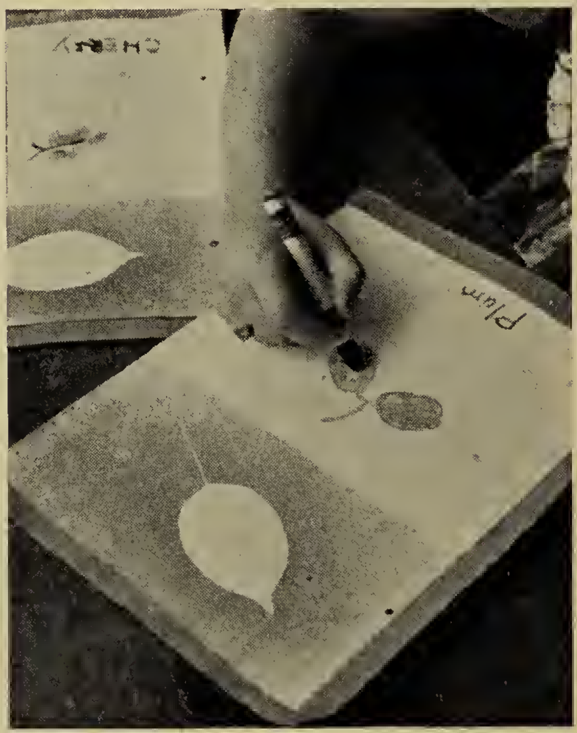
CRAYON PRINTS

Crayon prints form one of the simplest ways of "finger printing" leaves. Lay a leaf, vein side up, on the table. Place over it a moderately thin paper and crayon over the leaf, making the strokes all parallel and holding the paper firmly. The outline of the leaf and the veins show up clearly. Cut the leaf out and paste it in a book or use it for party decorations. Try doing the fall leaves in their bright colours. Use them in a mural or border.

DRIPRINTS

Less familiar than blue prints, but every bit as much fun are the driprints which come out in three colours—madrone red, royal blue, and black. Unlike the blue prints, the flower or leaf is coloured and the background white. For silhouettes and maps they are the best to use, but for lifelike duplication, blue prints which have been coloured are more satisfactory. Driprints may be made on a hike or a field trip, or back at home after a collecting trip.

Use frames similar to those described under "Blue Prints" and proceed in the same



manner. Expose the prints to the sun until the yellow colour has gone from the paper. This will take fifteen to twenty-five seconds for the red, twenty to thirty-five seconds for the blue, and forty to fifty seconds for the black. Do not wash these prints. Roll a number of them in a loose cylinder and put them in an inverted tin can (number ten) on top of a dish of concentrated ammonia covered by a screen. (The ammonia must be bought with the paper or at a drug store; washing ammonia is not strong enough.) The ammonia fumes bring out the colour and set the prints. Leave the prints for two or four minutes if the ammonia has just been poured, but longer if it has stood a while. Take care not to turn the can over when removing prints, for the fumes will escape. Over-fuming makes the colours ugly and dark; underfuming leaves the prints pale and not permanently fixed. You can take these prints out, sort out those which have been exposed to the fumes long enough, and put the others back. Fume the prints in the shade or in dim light.

Paper cut five by seven inches is of convenient size, and several small specimens may often be printed on one sheet. Maps and drawings on cellophane are effective when printed, for all lines are black, red, or blue, depending on the colour of driprint paper you are using.

SPATTER PRINTS

Spatter prints are fun to make; children of all ages and even adults enjoy making them. But if this is to be a nature activity, be sure to stress the nature end of it so that it will not become exclusively a handicraft project. You can keep it in the realm of nature by having as your objective a collection of prints of leaves, ferns, and grasses, a study in leaf shapes and margins, or the use of natural objects for designs, as, for example, spattering a spray or series of leaves for a design on a table runner, wall hanging, or screen.

Lay a leaf, fern, or flower (preferably pressed for several hours) on a sheet of typing paper or other paper cut an appropriate size. Hold a four inch square of copper window screen above the leaf and rub across the screen with an old discarded toothbrush which you have dipped in poster paint thinned with water to the consistency of thin cream. Fine spatters will fall through onto the paper. When the leaf or fern is lifted, its silhouette remains. Do not remove the specimen until the print is dry.

A few more hints may help you. Cover the table with newspapers and cut the paper into assorted sizes before you begin. If possible, let each child spatter leaves he has collected. Fresh leaves may be spattered if the paper is laid on cardboard (to protect the table) and pins put in upright to hold the curled parts down. Pour not more than half an inch of paint into cups in the centre of the table. The secret of success in obtaining a fine spatter lies in having very little paint on the brush. If there is too much, it will fall through in messy gobs. Dip the very tip of the brush into the paint and then wipe off the excess on the inside (not the rim) of the cup, holding it firmly with one hand to avoid tipping.

INK PRINTS

Ink prints are one of the most successful ways of fingerprinting leaves or fern fronds. They can tell a story of leaf shapes, of leaf margins, of venation, and of fern spore cases; they also make a convenient, realistic, and sturdy type of leaf collection.

Buy a tube of printer's ink—green or black; black is the cheapest, green most naturalistic—from the printer's or a stationery store, and a rubber or gelatin ink roller or brayer of the type used for block prints. If possible, have two rollers, one of which you will not ink.

Squeeze out a half-inch of ink on a glass, mirror, or photographic plate. Spread evenly and thinly with the roller, and lay a leaf, vein side up, on a cardboard. Run the inked roller over the leaf, inking it evenly. Pick up the leaf by the stem and place it inked side down on typing paper cut an appropriate size and placed nearby on the table. Lay a square of newspaper over the leaf and paper, and, holding the paper firmly with one hand, rub over the leaf firmly with the clean roller, following all outlines and covering the entire area. Take off the newspaper, crumple it and throw it away, peel off the leaf, and its likeness remains on your paper. Initial it and set it aside to dry—a matter of several hours.

Other suggestions are: add more ink from time to time as the supply gets low on the glass; if it seems to be drying up, add a drop or two of turpentine or kerosene. Leaves

which have prominent veins, irregular margins and "furry" or hairy surfaces often make the most attractive prints. Fern fronds are excellent because of their irregular margins and the fact that the spore cases on the back of fertile fronds show in the print. If you have a large group, tear up newspapers and cut the typing paper into assorted sizes before the group begins to print. Good results may be secured by holding the newspaper firmly with one hand and rubbing with the forefinger of the other hand with firm, even pressure over the area occupied by the leaf or fern. Printer's ink will not wash out. Use turpentine or kerosene to clean the roller and glass.

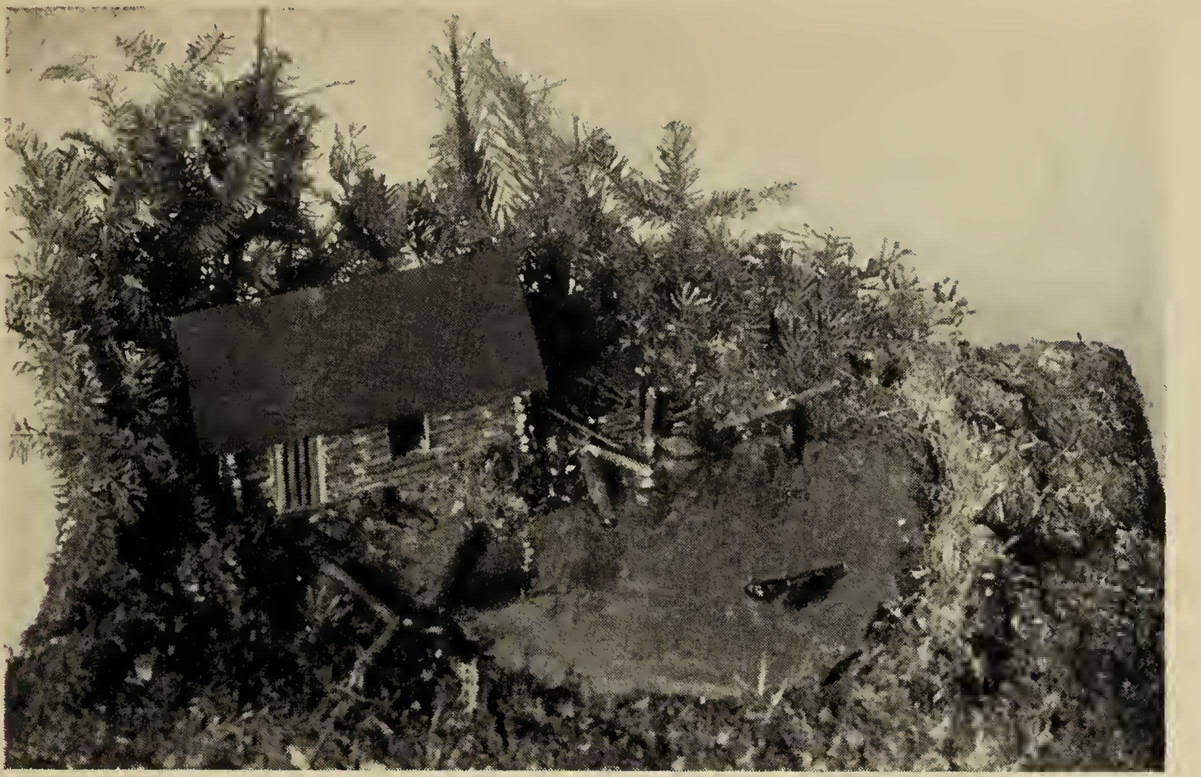
PLASTER CASTS

You will find this simple, inexpensive project an exciting one which you can use indoors and out and at all seasons of the year. There is scarcely a collection you can make which cannot be done in plaster casts. You can cast flowers, ferns, leaves, twigs, seeds, and animal tracks, and you can use plaster plaques for mounting minerals as well.

The first thing to do is to find or make a track or impression to cast. If you are indoors, roll out on paper some plasticine (kindergarten clay) into a sheet about one-half inch thick. Now press into it, by rolling with a glass, a leaf, flower, twig, or fern, or press a nut or seed half way in. Remove the specimens carefully. Make a wall of a strip of cardboard, celluloid or zinc about two inches wide and eight to twelve inches long, fastening the ends together with a paper clip. Press this into the clay, encircling the impression and leaving an ample margin.

If you are outdoors casting an animal track in mud, build a wall of mud or use a cardboard or celluloid ring (as indoors) around the track. The wall should be at least an inch high. You are then ready to pour in the plaster. If the track is in dust, you will have to spray a very watery solution of plaster over it and let it set before you put on the wall and pour in the thickened plaster, or else the heavy plaster will wash out the track.

Now for mixing the plaster for these casts you have set up. Use a can and a stick for mixing purposes, for plaster of Paris sets with a vice-like grip on the container, and it is practically impossible to get it off dishes, spoons or pans. Fill the can with the amount



AS PROJECTS, materials of historical figures and events are of interest. Perhaps Gray Owl's keen awareness of wildlife protection and the beaver's connection with the early development of Canada is one reason for the absorption of the youngsters in this project. The boys have reproduced Gray Owl's log cabin in Prince Albert National Park. They carefully cut and fitted together twigs for the logs that were then chinked. The boys learned to distinguish different kinds of evergreens. Twigs from some of these simulated the forest at the edge of the lake where the cabin was built. The small beaver pond was reproduced using several coats of shellac spread unevenly over a piece of mirror to suggest ripples. The beaver, pushing a log, was modelled in clay, painted, and placed in the water to suggest active swimming. Some plants, animals and birds were modelled and used.

of water necessary to fill the mold to a depth of about three-quarters of an inch. Now sift in plaster of Paris (obtainable at hardware stores for about six or ten cents a pound), letting it sink to the bottom. When no more will sink, add a dash for good measure and stir until it is the consistency of thick cream. Pour into the mold. It is not well to stir while adding the plaster nor to try to thin it with water. Salt will hasten a setting; vinegar will retard it. When the cast is "set", remove wall and clay, and your cast is finished.

MISCELLANEOUS

Other forms of arts and crafts include:

Basketry—Weave your own designs into the baskets you make, and use native materials whenever you can.

Carving—Carve out totems and figures of animals for camp; also buttons, buckles, spoons and forks. Try bone carving.

Indian Crafts—Closely akin to nature are the Indian crafts, many of which might be included among those listed. Others are authentic drums, camp equipment, costumes, tepees, lanterns and ceremonial articles.

Clay Modelling—Make simple bowls and models of animals. Find a clay bank and, if you can, use clay from it.

Audubon and Other Nature Clubs

BETTY PRICE

We have been called a nation of "joiners", and it is true that both children and adults like to belong to clubs. Witness the many "gangs" of children and their grown-up counterpart of fraternities and societies. Nature clubs make for a more closely knit group which tends to travel more intensively the road to nature than general groups, but they require more intensive and continual preparation of their leaders.

Types of Clubs

There are several types of nature clubs which can be formed. There are general clubs, such as the Junior Naturalist and Nature Clubs which explore all the various phases of nature. These are perhaps the easiest for the untrained leader, who generally has but a smattering of knowledge in a number of fields. Clubs formed in specific fields require greater knowledge and more preparation on the part of the leader to keep them going. Such clubs include bird, insect, pet, flower, tree, geology, collecting, museum, weather bureau clubs, and the like. A third type of club is formed by affiliating with or joining such national organizations as the Audubon Junior Clubs, the Audubon Society of Canada, or starting a Girl Guide or Boy Scout troop and emphasizing the nature part of these programmes. All these organizations provide literature and programme helps for you.

Starting a Club

Whatever type of club you choose, let it grow out of some activity rather than out of a mere statement that a club is to be formed. One leader, receiving no response to an announcement of the formation of a club, took a snake to the game room, let the children see and handle it, and in a very short time had an enthusiastic nucleus for a club. In another city the nature specialist brought some live animals to the playground. After displaying them, he suggested that the children go on a hike in a few days. Following the hike, the group formed a club. After a pet show, those who are interested in pets may form a club. Children especially interested in some aspect of a general programme such as collections, museums, birds, and so on, may be banded together into small clubs or committees.

Club Organization

You will not find it hard to start a club. The difficulty comes in keeping it alive and active and the members busy and interested. Your enthusiasm and preparation will count for much and in addition there are certain simple techniques which will help. Each club should have some central interest or special project such as a play, programme or exhibit. The programme must be diversified and the keynote "doing", with every member participating actively. Therefore, take as many field trips as possible, plan a diversified programme involving handwork, games, songs, stories, reports, outside speakers, and the handling and observing of natural objects.

If the group is kept small, it will facilitate participation for then each member has the opportunity to make a plaster cast, to get close enough to see the caterpillar changing its skin, and to handle the turtle. (Sixteen is a good number for junior clubs.) Limit membership to children of nearly the same age. Club organization with officers, a simple constitution, and perhaps dues of a few cents makes the members feel that the club is theirs—and so it is—and provides the machinery for the members to plan their own programme, which they should do as far as possible. The business organization should be kept simple and informal. The frequency of meeting will depend on the leader's time, but weekly meetings have been found successful in a number of communities. Since weekly meetings do not allow you to cover ground very rapidly, it is fun to plan "quests" to be made during the week. Perhaps each person discovers all he can about earthworms, and reports on it at the next meeting.

Audubon Junior Clubs

More than 8,500,000 children have become members of these clubs. For nearly half a century the National Audubon Society has worked to advance public understanding of the value and need of conservation of soil, water, plants and wildlife and their relation to human welfare. To kindle the children's appreciation of this national heritage, the Audubon Club is one of the best means towards stimulating a lasting interest in national policies furthering conservation.

Each member receives a membership button, seven leaflets with coloured plates, a membership certificate and activity suggestions. A junior member pays only 15 cents dues per annum. Each advisor or organizer of the club pays $1.00 registration fee and receives the magazine, *Canadian Nature,* and a 96-page booklet entitled the *Audubon Teacher's Guide,* a fund of suggestions for the club during the year. Child members may contribute to the *Audubon Junior Club News* which is printed and distributed to all clubs. Enrollments in Canada are received by the Audubon Society of Canada, 177 Jarvis St., Toronto 2, Ontario.

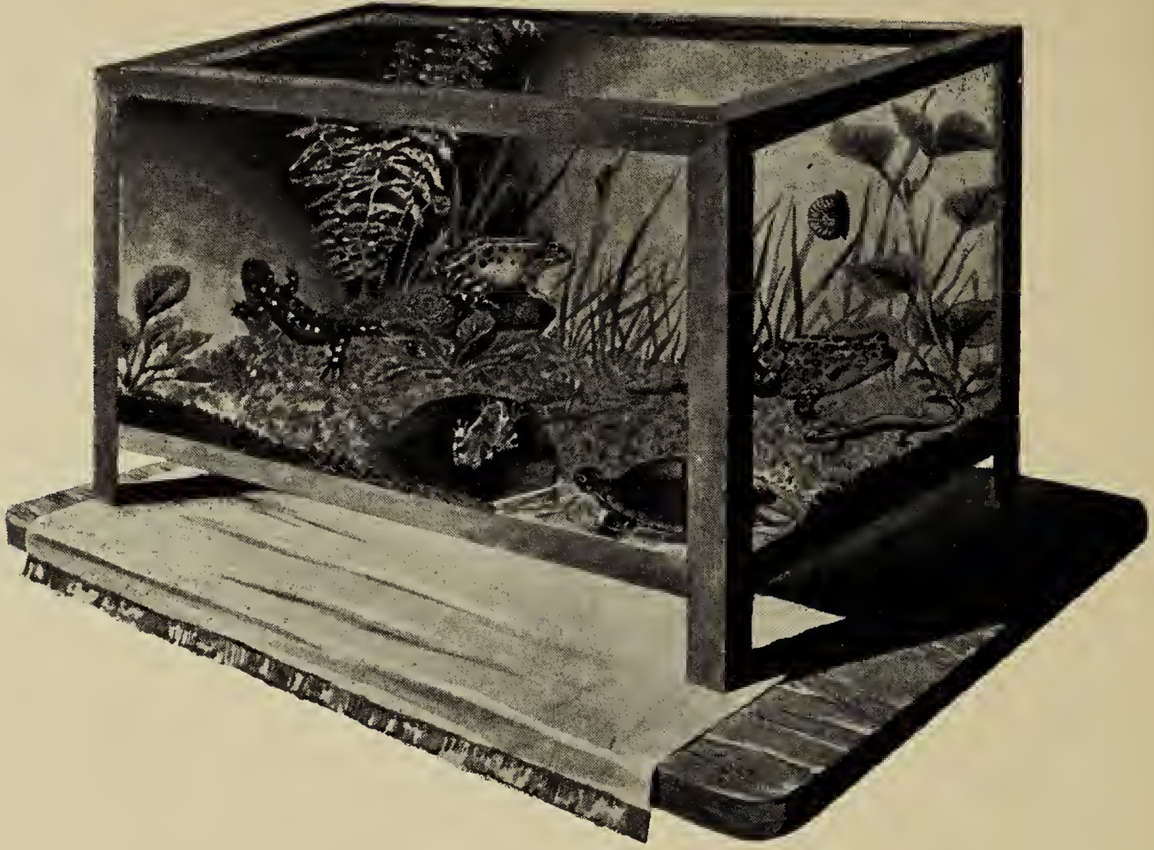
All clubs of this type serve as directives for the activities of school day and out-of-school interests and thus build better citizens.

Planning a Terrarium

E. B. S. LOGIER

As the name Terrarium implies, this type of cage imitates a natural terrestrial environment. An inexpensive one may be constructed of wood or made from a wooden grocery box, fitted with a sliding pane of glass in the front and with glass or screen back. If the back is of glass, there should be a large screen ventilator in the top or at either end. There should be a trap door in the top large enough to insert the hand in order to care for the occupants. The cage should have several coats of good water-resisting paint inside and out. Good earth should be put on the bottom and piled up several inches higher toward the back; attractive pieces of rock may also be set in. An enamel or glass dish should be sunk in the earth for holding water, and a few stones placed in one end to enable animals to climb out of it easily. The earth should be planted with any desired small terrestrial plants, which should be watered occasionally as though they were growing in ordinary flower pots. A set-up of this kind is satisfactory for any of our small terrestrial snakes, skinks and toads.

Aqua-terraria is a name applied to cages which combine both aquatic and terrestrial conditions. Such cages are ideal for keeping amphibians and such reptiles as turtles, water snakes, etc. Use an ordinary aquarium tank of say 12 x 12 x 24 inches or larger. At one end or along the back lay some flat stones to a height of about three inches. Procure some water-loving plants from bogs, marshes, lake shores or ponds, plant them



in their own natural earth in small pots, and arrange them on top of the flat stones. Around and between the pots pile up stones and coarse sand or gravel to the tops of the pots, and arrange moss over the top of this and between the plants. Fill the tank with water to a depth of three or four inches, that is, to about the bottoms of the pots, and cover the tank with a pane of glass. This arrangement is good for amphibians. For reptiles it is better to use a screen top for ventilation, since even aquatic reptiles like to get themselves properly dried off sometimes.

Most of our amphibians will thrive on a general diet of worms, insects and other small invertebrates such as spiders, sowbugs, etc. Newts and salamanders (Spotted and Jefferson's) will soon learn to take bits of meat or fish from the end of forceps, as will most of the frogs. The Bullfrog will also take small crayfish and minnows. Most of the frogs and salamanders (including newts) will eat any small living thing that moves. The little Red-backed Salamander may be fed with small earthworms, *enchytrae* worms, fruit flies, small ants, etc. Fruit flies are also good for the small frogs, but it is well with all these animals to vary the diet. Mealworms are very convenient for feeding, but the diet should not be restricted too much to these. The food of snakes varies with the species, but they are all strictly carnivorous. Our native turtles are in the main carnivorous, and may be fed on any kind of fresh (unsalted) raw meat, fish, earthworms and insects. They probably all eat a certain amount of vegetable food also.

How often to feed amphibians and reptiles depends on how warm they are kept and on the species, and also on the quantity fed at one meal. If kept at ordinary house temperatures through the winter, they will feed moderately, though not as much as in the spring and summer. If kept cool, say below 50 degrees F., they will feed less, or not at all in the case of reptiles. Turtles and snakes often refuse food in winter even when kept fairly warm, but this varies with individuals. At temperatures of about 60 degrees F. up, frogs will take food every day. Salamanders and newts need about two good feedings a week, but if given small quantities will feed every day. Garter Snakes, Water Snakes, and the Red-bellied and Dekay's Snakes will feed every two or three days in summer, once a week or less in winter. Those which take mammals and birds will feed less often, one good meal a week in summer and one about every three or four weeks in winter.

Turtles will feed every day or every second day in summer, but in winter will often refuse to feed more than once in a week or two weeks, or may even cease to feed for a month at a stretch. The water in an amphibian or reptile cage must not be allowed to become polluted. If it begins to get fetid, it should be changed at once.

Snakes shed their skins several times a year. Before shedding, their eyes become milky and they usually stop feeding. A skin that should be shed will appear dry, wrinkled and very dull, and this condition will usually be evident about two weeks after the milky appearance has cleared from the eyes, or partially cleared. The skin should normally be shed by this time, but if not soak the snake in tepid water for two or three hours. loosen the skin at the tip of the snout and chin and at the edges of the lips, and roll it slowly backward inside out, being careful that the scutes covering the eyes come with it.

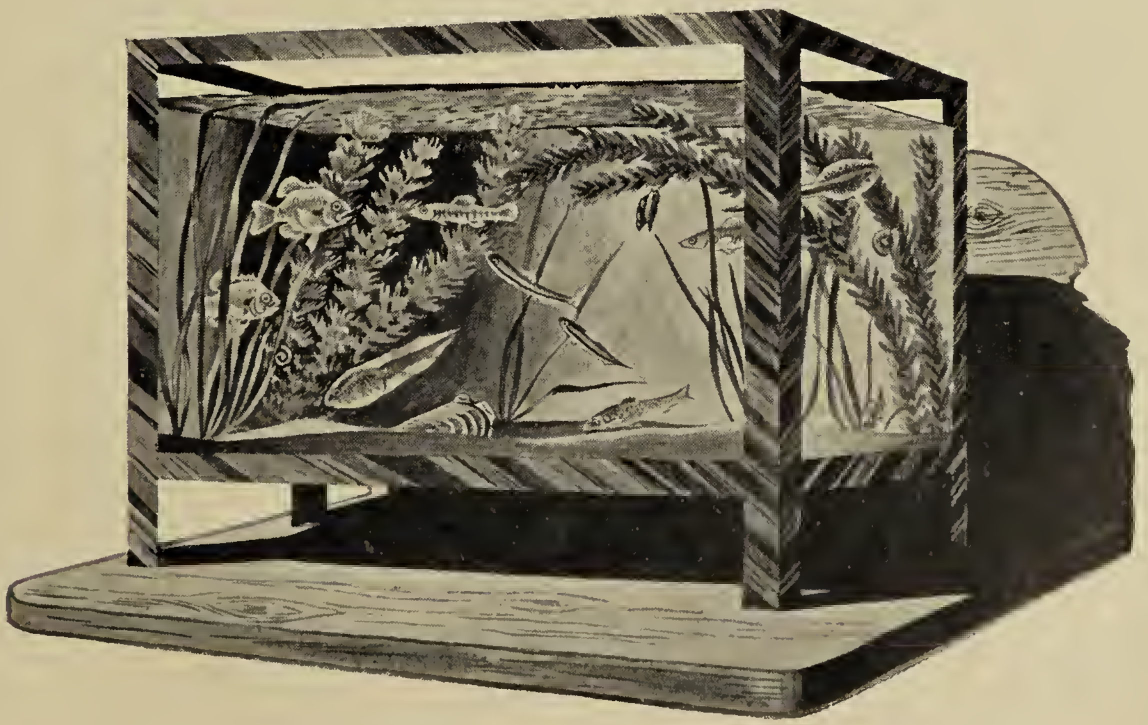
People often ask what to do with turtles, snakes, salamanders and frogs in the winter. If kept in a very cool cellar or slightly heated greenhouse, they will likely remain inactive much of the time, and require little attention; but if kept at ordinary house temperature they will remain fairly active and feed at least a little. Salamanders and frogs may be wintered in wettish moss in a cool place. Turtles should be wintered in a tub or tank with several inches of sand, and sufficient water over it to cover them completely. There should be some stones and moss or other elevated object on which they may climb out of the water. If they wish to hibernate, they will bury themselves in the sand beneath the water.

Planning an Aquarium

E. B. S. LOGIER

THE following directions for setting up and operating an aquarium will apply either to tropical or native fish, the only important difference being that many tropicals require a uniformly higher temperature, usually between 70 and 78 degrees F. Our native species will do very well in temperatures between 60 and 70 degrees F.; a number of them will stand the higher temperatures too, if brought gradually to them.

The best kind of aquarium is the rectangular tank with panes of strong clear glass cemented into metal corners. Untreated natural water as from ponds or lakes is best,



but city water is more convenient for city dwellers. Allow such water to stand for a day or two before using, to get rid of any dissolved chlorine gas and excess dissolved air.

Any clean beach sand or the white sand sold by aquarium dealers is good for rooting the plants. It should be thoroughly washed and stirred in running water or repeated changes of water until all dust is removed.

Wash the tank thoroughly with warm salt water and place it in its permanent position, levelled so that it does not rock. Place the washed sand in the bottom, sloping it from about an inch deep at the front to about two inches deep at the back. Next fill to about six or eight inches deep with water. Now arrange the plants, burying the roots or the bases of the stems in the sand and grouping them mostly along the back and sides of the tank, leaving the front and centre clearer. Some rock work may be introduced if desired. Natural pieces of quartz or feldspar or other kinds of stone are preferable to the artificial castles sold for this purpose. When planting and rock work is completed, the tank may be filled up to within an inch or less of the top. To fill without disturbing the sand and plants, place a sheet of paper in the tank and pour the water slowly on top of it. It is best to let the aquarium stand for a day or two before introducing the fish, although this is not always essential. When stocking the tank, do not overcrowd; a safe rule is one inch of fish to each gallon of water. Before the fish are introduced, the temperature of the water from which they are being taken should be gradually brought to about that of the tank, or the reverse.

The aquarium should be placed in a good light if the plants are to function and aerate the water, because only under such conditions do they consume carbon dioxide and liberate oxygen. About two hours or less direct sunlight each day is beneficial but not essential. An electric light bulb placed about a foot above the water will do instead of daylight for most plants. If the fish crowd to the top gulping air, it indicates that the dissolved air in the water is nearing exhaustion. This may be owing to (a) overcrowding, (b) pollution of the water by a dead animal or unused food refuse, or (c) insufficient light causing the plants to fail to function. If the cause is pollution, the water will usually be murky and, when stirred, give off a faintly fetid smell. To correct this, syphon the rubbish from the bottom of the tank and replace about half of the water with fresh water of about the same temperature, and of course remove any dead animals.

If the trouble is not pollution or lack of light, it is probable that there are too many fish or too few plants. Too much light will stimulate the growth of algae, and often produce "green water" which, while not detrimental to fish, is objectionable in that it makes it difficult to see the occupants of the tank. A few small clams will clear the water, and the light should be subdued a little. It is well to cover the aquarium with a pane of glass.

A great variety of plants are available for aquarium planting, and may be obtained from dealers in aquarium supplies, and some of our native aquatics are also good. The primary function of plants in the aquarium is to supply oxygen and to use up the carbon dioxide given off by the fish. With proper proportions of fish and plants the aquarium should "balance" itself and not require change of water.

Animals for ordinary aquaria are best selected from the species that normally inhabit still water. No elaborate collecting equipment is required: one or two hand nets, a gallon or half gallon pail with a handle, or a few sealers are sufficient.

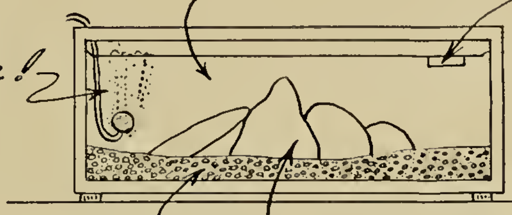
When using a large net in open water, it is best to make a quick sweep down, toward you, and up clear of the water. Good results are often obtained with a net dyed brown or green, by holding it still with one edge of the hoop on the bottom and chasing animals into it, but if the net is white they will often attempt to by-pass it. By dragging in a netful of bottom trash which can be examined at leisure in the bag of the net in shallow water (keeping the rim above), such forms as mud minnows, tadpoles, newts, aquatic insects, crayfish, snails, etc., will be secured.

The pail or jars should be ready, filled half or three-quarter way with water, so that fish, tadpoles, etc., may be transferred quickly from the net. Such animals should not be kept out of water for longer than can be avoided, nor handled with dry hands. Adult newts may be carried in wet weeds. They breathe by lungs and may drown in deep

MARINE AQUARIA

— J. Lynton Martin.....

THE TANK!



USE PURE SALT WATER FROM OPEN OCEAN

MARK WATER LEVEL AND ADD FRESH WATER TO REPLACE LOSS BY EVAPORATION

GIVE LOTS OF AIR!

USE COARSE GRAVEL AND SAND MIXED; NEVER USE FINE SAND ALONE!

USE ROCKS FREE FROM COPPER OR OTHER METALS

THE LIFE!

Starfish

Barnacle

Limpet

Clam

Snails

Lobster

Rock Crab

Hermit Crab

Killifish

SELECT SMALL SPECIMENS, AND ONLY ONE OR TWO OF EACH KIND. THEY WILL BE MUCH HARDIER IF COLLECTED FROM TIDEPOOLS SINCE THE ANIMALS FOUND THERE ARE USED TO A WIDE RANGE OF TEMPERATURES AND SALINITIES.

Sea Lettuce

THE DON'TS!

DO NOT USE BROWN ALGAE!

COPPER | ALUMINUM | BRASS

AVOID THESE METALS!

NO SEA URCHINS PLEASE!

Newt

(Lower) Black-nosed Dace (Upper) Killifish

Frog Tadpole

Clam and Pond Snail

water during transport. Never fill your containers up to the lid; always leave a good air space. Don't overcrowd your animals; and don't leave your containers standing in the sun.

Most of our small native fish of the minnow family, which includes the various chubs, shiners, dace, etc., and such forms as the mud minnow, killifish, young catfish and suckers, will live peacably together. Carnivorous and quarrelsome species such as various members of the sunfish group, including the rock bass, pumpkin seed sunfish and others, sticklebacks and young pike and gar pike, should be fairly well-matched as to size, and as a general rule it is best not to put together fish of any kind in which the size difference is so great that the large ones could swallow the small ones. Goldfish are not entirely desirable in the planted aquarium because they eat the plants.

Tadpoles or frogs may be kept in an aquarium with the less aggressive varieties of fish, and are very useful as scavengers, eating food refuse on the bottom, and algae. Snails of various species are usually kept in the aquarium, and are valuable as scavengers and in the control of algae on the glass. The most useful and active species are our common pond snails of the genus *Physa.* The various *Planorbis* or ramshorns are also good. The large pond snail, *Lymnea stagnalis,* although very attractive, is best not used, as it is a plant eater and may do considerable mischief. A few small-sized clams are useful in keeping the water clear. Care should be taken to inspect the clams each day to make sure they are alive. This may be done by tapping the shell with a stick; if living, they will close. Dead clams and snails should be removed at once. Newts may be kept along with fish, provided the fish are not too small.

The food of fish varies according to species. Carnivorous species should be fed with such foods as chopped raw liver, canned shrimp, chopped earthworms, *Enchytrae* or white worms, aquatic larvae of midges and mosquitoes, etc., and small aquatic crustaceans such as water-fleas and fairy shrimps, or the little "fresh-water shrimps", *Gammarus.* All of these foods are not necessary, but it is advisable to vary the diet, and live food of some sort should occasionally be used. Most minnows are general feeders, eating both animal and vegetable foods. They will eat any of the above meat foods and also cereals, whole wheat breads, puppy biscuit, etc. Do not use "rice wafers" so commonly sold for fish food, as they are practically pure starch, and fish soon die if kept on such a diet. By sweeping a pond or quiet stream with a fine mesh net, quantities of live food may be collected in a few minutes.

When feeding with food that is not alive, do not put more in the aquarium at one time than the fish will use in five or ten minutes; and any refuse that the tadpoles and snails have not consumed within an hour or so should be removed. Once a day is often enough to feed, and there is no harm done by occasionally missing a day.

How to Attract Birds

THE fact that birds feed on practically all insect pests would make their presence around your home desirable even without their beautiful colouring and lovely songs.

A simple way to attract, enjoy, and enlist the services of birds is to provide them with suitable and convenient ready-made homes.

To be satisfactory, bird houses should be well-built, durable, cool, rain-proof, and accessible, since they should be cleaned after each brood's departure. Painting the houses increases their resistance to weather and adds to their attractiveness—brown, gray, and dull green are preferred colours for painting.

The roof of a bird house should slope sufficiently to shed water, or should have a groove cut across the face of the overhanging part. It should overhang the entrance by 2 or 3 inches, to keep out driving rain. Holes bored on an upward slant help to serve this purpose also.

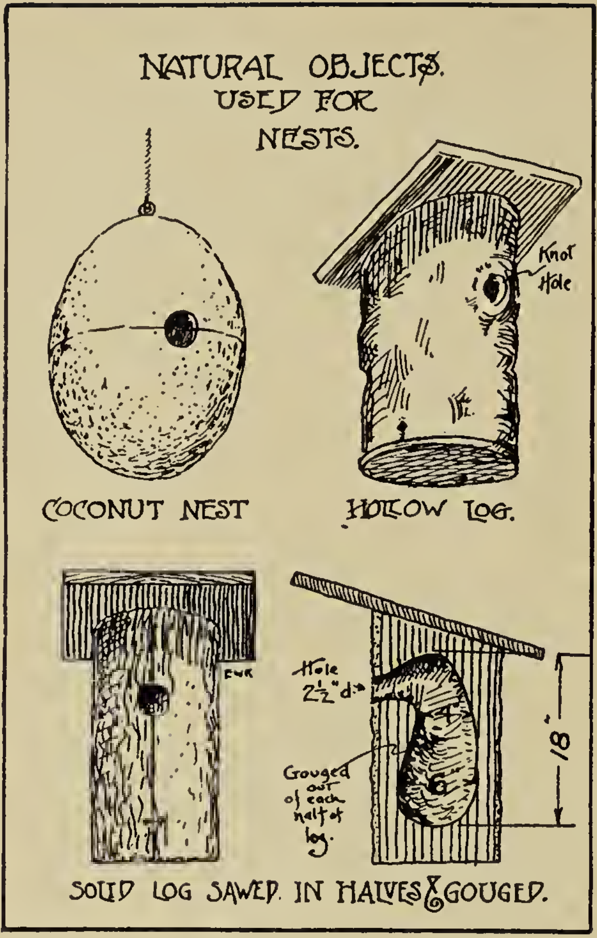
Ventilation should be provided by boring two or three augur holes through the side walls near the roof; this will allow heat to

DIMENSIONS AND LOCATIONS FOR BIRD HOUSES

Species	Floor of cavity, inches	Depth of cavity, inches	Entrance above floor, inches	Diameter of entrance, inches	Height above ground, feet	Location
Bluebirds	5 by 5	8	6	1½	5-10	Open sunlit orchards.
Robins	6 by 8	8	(*)	(*)	6-15	Shade trees or under eaves of shed or porch roof.
Chickadees	4 by 4	8-10	6	1⅛	6-15	Rustic homes in old orchards and borders of woodlands; suet and nut meats placed on trays in trees especially attract these birds.
Titmice	4 by 4	8-10	6-8	1¼	6-15	
Nuthatches	4 by 4	8-10	6-8	1¼	12-20	
House wrens	4 by 4	6-8	2-6	⅞	6-20	Shady or partly sunlit spots about door yards or orchards.
Bewick wrens	4 by 4	6-8	2-6	⅞	6-20	
Carolina wrens	4 by 4	6-8	2-6	1	6-20	Borders of woodlands or in brushy areas.
Violet-green swallows	5 by 5	6	1-5	1½	10-15	Dead trees near bodies of water.
Tree swallows	5 by 5	6	1-5	1½	10-15	
Barn swallows	6 by 6	6	(*)	(*)	8-12	Shelves placed under eaves of building.
Purple martins	6 by 6	6	1	2½	16-20	On poles in open spaces near water.
Song sparrows	6 by 6	6	(†)	(†)	1-3	Covered shelves in thickets.
House finches	6 by 6	6	4	2	8-12	Shrubbery in orchards or dooryards.
Phoebes	6 by 6	6	(*)	(*)	8-12	Bridges or barns near bodies of water.
Crested flycatchers	6 by 6	8-10	6-8	2	8-20	Orchards, open woods, or in trees in pastures.
Woodpeckers	6 by 6	12	10	1½	12-20	

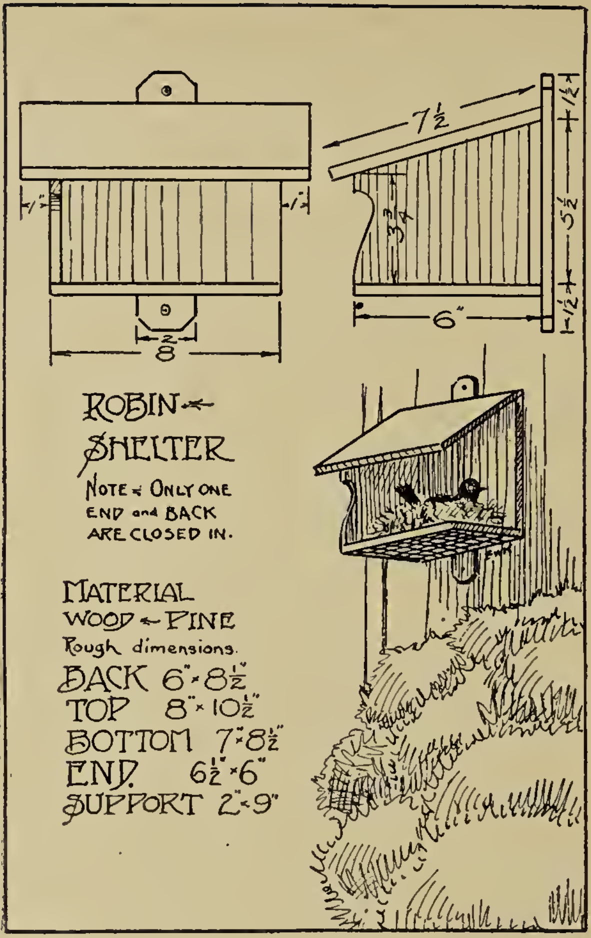
* 1 or more sides open.

† All sides open.



NATURAL OBJECTS. USED FOR NESTS.

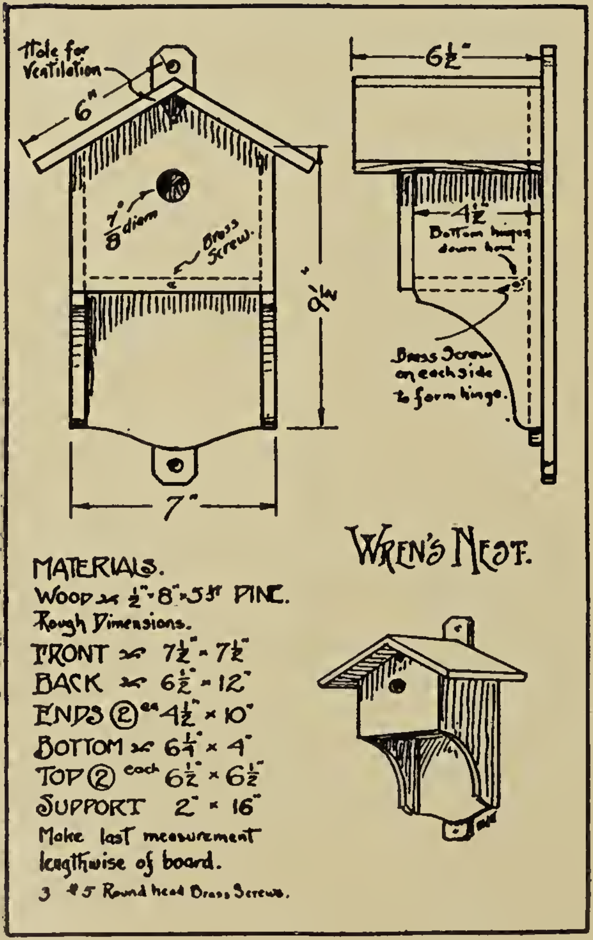
SOLID LOG SAWED. IN HALVES & GOUGED.



ROBIN SHELTER

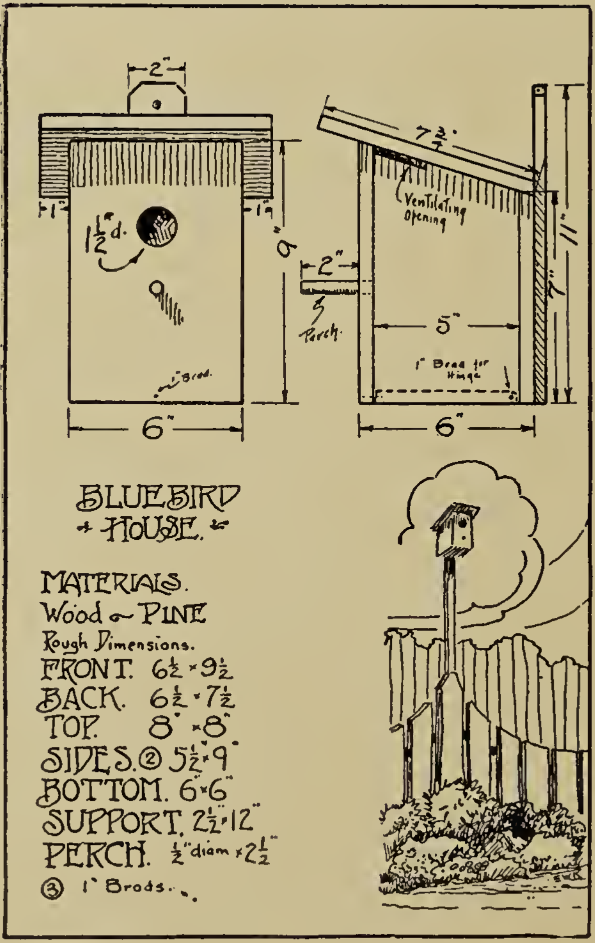
NOTE – ONLY ONE END and BACK ARE CLOSED IN.

MATERIAL
WOOD – PINE
Rough dimensions.
BACK 6"×8½"
TOP 8"×10½"
BOTTOM 7"×8½"
END 6½"×6"
SUPPORT 2"×9"



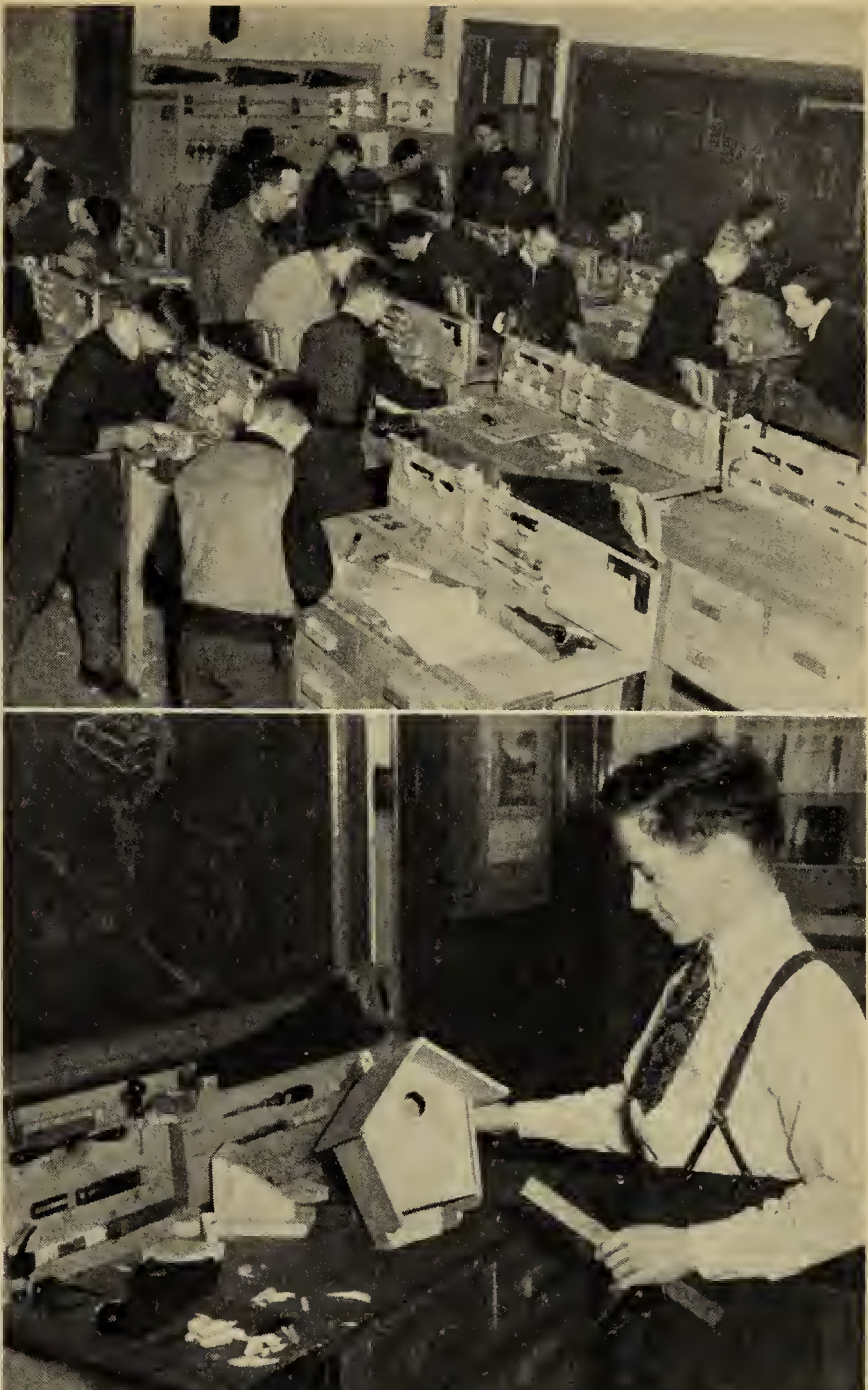
WREN'S NEST.

MATERIALS.
Wood – ½"×8"×5 ft PINE.
Rough Dimensions.
FRONT – 7½"×7½"
BACK – 6½"×12"
ENDS ② ea 4½"×10"
BOTTOM – 6¼"×4"
TOP ② each 6½"×6½"
SUPPORT 2"×16"
Make last measurement lengthwise of board.
3 #5 Round head Brass Screws.



BLUEBIRD HOUSE.

MATERIALS.
Wood – PINE
Rough Dimensions.
FRONT. 6½×9½
BACK. 6½×7½
TOP. 8"×8"
SIDES. ② 5½"×9"
BOTTOM. 6"×6"
SUPPORT. 2½"×12"
PERCH. ½"diam×2½"
③ 1" Brads.



Teaching handicrafts at St. Charles' School, Limoilou, P.Q.

escape without making draughts, to which young birds are particularly susceptible.

The inner walls of bird houses should be roughened or grooved, to help the young ones in learning to reach the entrance.

Rustic effects that are as natural as possible are usually good. They may be obtained by first constructing the house in the ordinary way and then covering it with cedar bark. The bark is best if peeled off old fence posts, cut into proper sizes, and fastened to the house with short brads which should not stick through on the inside surface. One objection to the bark is its ragged appearance if not kept in repair; otherwise it makes a useful and attractive exterior.

Most birds like to be out of sight when incubating the eggs and this means that the entrance hole should be well above the centre (martins excepted).

Tin cans are not desirable. They will heat in the sun and bake the nestlings.

Birds like sunlight. Fasten house to trunk of tree, well down away from foliage or place on a fence post or pole where it can easily be seen.

Build one-family houses (except for martins). Most songbirds have their own territories and will not tolerate another family under the same roof or even as a near neighbour. Only three or four houses to an acre is a good rule.

Feeding Bird Guests in Winter

A SURPRISING number and variety of birds may be attracted in winter, even to city gardens, by putting out suitable food in safe, attractive feeders. Common chicken feed can be used, but there is the disadvantage to it that some of the grains are broken and when exposed to moisture will quickly mould with, sometimes, disastrous results to the birds. Also, there are a number of seeds and grains in the chicken feed that will only be eaten if there is nothing else available. It is advisable to use some mixture specially prepared for wild birds, which usually contain such seeds as sunflower, canary, millet and other whole seeds and grains that wild birds are fond of, and very little or no cracked grain. Peanuts or other nut meats are always welcome, raisins, pieces of apple and lettuce are cherished by some, and bread crumbs. One of the most important foods is suet, preferably beef suet, which should be available at all times, for birds have a high body temperature and need considerable fatty substance to maintain it.

Several types of feeders might be mentioned. I believe that the window feeder is by far the best, for with it one can more easily watch and better enjoy the birds that come to feed. This feeder rests on the window sill and the food can be replenished by merely opening the window—quite an advantage in cold, stormy weather. Another very effective feeder, especially for the smaller climbing birds, as the chickadee, the nuthatch, and the woodpeckers, is the suet stick. This is a stick fifteen to eighteen inches long drilled with a number of holes into which is packed a mixture of suet, seeds and nuts. Then, if one is bothered with squirrels, a trolley feeder running on a wire between a house and a tree or between two trees, will usually solve that problem, for it is hard for squirrels to run along a wire. Do not make the mistake of using a rope for they will run along it nearly as easily as if they were on the ground. The hanging feeder and the type which is placed on top of a sturdy pole, are also good if kept out of the reach of prowling cats.

Start to put out feed about the first of October, so that the birds will know where to find the food long before winter sets in. Then, too, if you start early there is always a chance that some bird which normally goes south for the winter may stay over as your guest because of the available food supply. Put out only a small quantity at first, and increase it as cold weather advances, but try not to put out more than will be consumed in one day, unless it is in a hopper.

The friendly Chickadee will be one of the first to discover your bounty. With him may come the White-breasted Nuthatch and the Downy Woodpecker. The saucy but beautiful Blue Jay is almost sure to be your guest, especially if there are peanuts.

Seventy-seven Nature Games

WILLIAM GOULD VINAL

A Nature Game is not a substitute for Nature Education but is a part of it. Nature play is instinctive and has the power of developing the play habit. Childhood is the time for fixing this play habit in the out of doors. If neglected the individual will usually be deficient in that particular training. Man is the only animal that ever neglects or trains away from the games of nature.

Many of these games have been adapted from old games that have been handed down from generation to generation. It will take but a little ingenuity to modify them for new games. All the rainy day games may be played out of doors. They are classified this way as a matter of convenience in using them.

Test of a Game.—Is it used spontaneously afterwards? What does it teach? What physical, mental, or moral traits does it develop? What social traits does it involve?

Suggestions.—Know your game. Play with spirit. Everyone take part—no porch or lounge lizards. When possible play outdoors. Old games by request. Always teach a new game. Change to fit conditions.

1. RAINY DAY GAMES

A. BIRDS

1. BIRD IDENTIFICATION. — Give each one a stuffed specimen or bird skin, a card or ticket, and a good bird key as Walter's or Wilcox's. When the student gets the right name from the key the ticket is punched, and a new bird is presented for identification. The one who identifies the greatest number of birds in a given time wins. The cards are gathered at the end of the time limit and a curve is placed on the board to show the number identifying 1, 2, 3, etc., birds. Each one then knows how he ranks with the average in ability to identify birds.

2. BIRD DESCRIPTION.—Have cards on which is written the description of birds. Read slowly. The one guessing the name first is given the card first. Anyone making a wrong guess has to give back a card. The Audubon Society cards are good for this. The phrases in the text should be numbered in the order that you wish to present the ideas. (Write to National Audubon Society, 1000 Fifth Ave., New York 28, N.Y., for current price list covering bird cards, bird charts, etc.)

3. SWAT THE BLINDMAN. — Have Audubon Charts hung on the wall. Have a player stand back to the chart and describe a given bird. This always furnishes a great deal of amusement to the audience. (Write to National Audubon Society, 1000 Fifth Ave., New York 28, N.Y., for current price list covering bird cards, bird charts, etc.)

4. HAWKEYE.—Cover up a bird quickly and ask questions. What colour is his throat? How many noticed white around the eye? This is fine training for observation. How many noticed that he is sitting on a limb? How many noticed that he is sitting on the ground? How many noticed that he is not sitting but standing?

5. GYP.—The group thinks of some bird. They are given several books in order to become well informed about the bird. "It" then comes in and asks questions which may be answered by "yes" or "no". The one asking the least number of questions wins.

6. BIRD SILHOUETTES.—Either the outline of the bird is cut out of black paper or the form of the bird is thrown on a cloth by a light. The one identifying the greatest number wins.

7. BIRD PICTURE CONTEST.—The coloured pictures of birds are cut into four parts—head, body, tail, and legs. The picture of the legs, and in the case of the seed eating birds, the beaks, are scattered on the following tables: ducks, other swimming birds, wading birds, tree trunk climbers, insect feeders of the air, birds of prey, and seed eaters. When the whistle blows the players select a picture of some bird's leg and from the characteristics of the leg tries to find the other parts of that bird. As soon as one picture is completed another leg is taken and so the game progresses until the supply is exhausted.

8. BIRD LOGOMACHY.—Use cardboard letters printed on one side. Place face down on the table. Players take turns drawing letters and placing face up on the table. When a player can make a bird name from

these letters he takes the letters and spells the word in front of him. The persons getting ten words first wins.

9. BIRD ROGUES' GALLERY. — Slips of papers are passed out to players and they are given two minutes to draw a picture of a bird for the Rogues' Gallery. The exhibit is then set up and the judges walk by the exhibit. Recognizable birds are given honourable mention (1 point). Birds represented in action may be given red ribbons or red pencil marks (2 points). The best sketches may be given blue ribbons or blue marks (3 points). The judging may be made very funny. The team getting the greatest score wins.

10. SPOTTING. A BIRD GAME FOR THE CAMP FIRE OR A RAINY DAY.—It seemed as if everyone had seen something interesting about birds. One small boy felt that he was letting an opportunity slip by and rose to the occasion by reporting that he had seen four robins pulling one earthworm out of the ground. A little girl, with much more tact than often exhibited by elders, said: "Gilbert, don't you think that you are exaggerating?"

On a similar occasion a boy described a bird that he had seen. From his own words it must have been wonderful to behold. He had borrowed a brilliant vocabulary and had used most of the colours of the spectrum when another boy arose and said, "Where did you see that bird?"

These are two instances of spotting people. Many observers with good intentions are not much more successful in their descriptions.

The object of this game is not to spot people but to spot birds when accurately described. The most general things are said first, and as the description goes on it focuses toward one bird until the name is finally given. Whoever first names the bird correctly receives a point. If someone gives the wrong name he is fined a point. Whoever has the most points at the end of the game wins.

The following are given as samples:

I am thinking of a bird that is seven inches long. He returns on a warm, sunny day in March, and gladdens the hearts of ramblers as he "carries the sky on his back and the earth on his breast." His song is of clear notes which poets have described as "pur-i-ty, pur-i-ty." He sets up housekeeping in a cavity of an old apple tree or in a well-built bird house. This thrush could hardly be mistaken for the Blue-jay and it is much larger than the Indigo-bunting. This bird is called the Bluebird.

I am thinking of a bird seven inches long. He is a friendly fellow and seeks the society of man. He is not noted for his colour as it is a dull gray above and white below. His tail is constantly "pumping". His nest is made of moss and lined with mud and hair. It is usually built under a bridge or in a shed. This flycatcher is often mistaken for the Pewee but it has a black bill and black feet. If you have not recognized it already you will when I tell you that it has a plaintive note which sounds like "Phœbe."

The bird which I have in mind is about thirteen inches long. He looks quite grand with his crest and blue coat. His white collar and dark belt make his uniform look quite trim. He has a harsh voice. He has a sharp eye and a sharp beak. (Up to this point it might be either the blue jay or the kingfisher.) To provide alertness the describer may fine whoever ventures a guess and proceed to set forth the other bird. He usually perches on a limb which overhangs a stream or pond. Suddenly he makes a dart to the water and comes back with a fish. Two of his toes are grown together which makes it easier to scoop a hole into the sand bank to make a nest for the young. This fisherman is the Kingfisher.

This bird is the length of a foot rule. He is brownish-gray and when you get him in the right light he is iridescent. The pointed tail is tipped with white. His wings whistle when he flies. His nest is made of twigs and the eggs are limited to two white ones. Some of you may recognize its Latin name, columba. It is related to the extinct Passenger Pigeon and because of its mournful song is called the Mourning Dove.

One of our most graceful aviators is about seven inches long and comes here from the tropics to spend the summer. The coming of the garage has made it difficult for him. His nest is made of pellets of mud and lined with feathers and is placed high on the rafters of the barn. He prefers to skim over the surface of water to gather insects. This bird wears the original swallow tail coat. It is steel blue in colour. His chestnut shirt is not so fashionable as the shiny one of his smaller relative the Tree Swallow. You now know that I refer to the Barn Swallow.

I am going to describe a bird that is about the size of the Canada Goose. It is dark above and white below. It has a long black neck with a white throat patch extending below each eye. Its nest is built on the ground and lined with down. As it seeks the northland in V-shaped lines its honking is music to many who cannot differentiate between the sweet toned warblers. Yes, it is the Canada Goose.

This game may be played with the Audubon Bird Cards. There are three sets: Spring, Summer, and Winter birds of Eastern North America from colour drawings by Allan Brooks. The sets are published by the National Audubon Society, 1000 Fifth Ave., New York 28, N.Y. The price per set, fifty in a box, is $1.50 postpaid. In order to facilitate the game the statements in the description on the back of each card may be numbered after the order of presentation. Camps may also place these cards on the bulletin boards to show the close-ups of local inhabitants.

B. TREES

11. TWIG MATCHING.—Obtain several kinds of twigs 8 to 12 inches long. Cut into two parts. Mount the lower half on a board. Drive staples in board to receive upper half of twigs. Scatter the other halves on a table. At a given signal the players observe closely one of the twigs and then run to the unmounted group to get the other half. If the wrong half is brought back he tries again. This game requires close observation. Leaves may be used in the same way, or flowers with short stems may be fitted to longer stems, or leaves to leaf scars.

12. JACK IN THE BOX.—A branch or flower is held up quickly from the back of a box. The players write down the names. See which team gets the highest average.

13. GETTING A CLUE.—Have a sheet of paper or cloth with a hole in the middle. Show the edge of a leaf, a little more at a time. Whoever gives the name correctly first is given the leaf. The one who gets the largest collection wins. Pictures of birds may be shown in the same way, the beak being the first to appear.

14. INDOOR TWIG RELAY.—Have a group of winter twigs scattered at one end of the room. Have as many of each kind as there are players. Show a twig, as the white ash. The players may look as long as they wish. Samples are then passed back and they are given 30 seconds to get a white ash twig. Everyone back in his seat with a white ash twig at the end of 30 seconds gets one point.

15. SPOT THE TREE.—Give each player a sample twig of a tree that may be seen from the window. The players go to the window and mark on a street map, if it be an elm for example, the elm trees spotted from the window. Maple twigs, horsechestnut, pine, spruce, etc., are well adapted. This is a very interesting game to train in the sense of long distance observation.

16. TREE SILHOUETTES.—Cut from black paper the silhouettes of trees. The trees particularly well adapted to this game are spruce, pine, elm, red cedar, weeping willow, palm, sugar maple, Lombardy poplar, and white oak. Hold up the silhouette for naming.

C. GENERAL

17. NATURE ALPHABET.—The leader names a letter of the alphabet. Each player in order names a bird, flower or tree (decided upon before starting) which begins with that letter. Anyone who cannot do so in less than five seconds is out. No one is to name an object which has already been named. The patrol having the greatest number at the end of a certain time is the winner, or the last member of a group to name an object commencing with that letter wins a point for his team.

18. AUTHORS.—A home-made set of bird or tree authors may be made which is similar to the well known game of authors. In authors there are 20 books of 5 cards each. The cards are dealt evenly to the players. Each in turn asks for cards until a player does not have the card asked for. When a book is obtained the cards are put down as a book. The greatest number of books wins.

19. GAME OF TOUCH.—The players are blindfolded and a natural object is placed in their hands. They have 30 seconds to tell of it. The name is then written down. Some objects particularly suited to this game are: various seeds, leaves, fruits, evergreens, flowers, barks of trees, nuts, feathers, shells, vegetables, and soils.

20. GAME OF SMELL.—As a variation a team may elect its "best smeller." The players are blindfolded and allowed to smell common objects. The name is then written down. Objects with a distinct odour are: mints, black birch, wintergreen or checkerberry, balsam, penny-royal, skunk cabbage, onion, parsnip, tomato, tansy, rose, sassafras, sarsaparilla, spice bush, turnip, cedar, kelp, apple, orange, mould, strawberry and cucumber. Strong odours such as skunk cabbage or onion should not be given first.

21. GAME OF TASTE.—Many of the objects suitable for smell are adapted to the game of taste. Others are rhubarb, sorrel, licorice, sugar, salt, clove, cinnamon, radish, catnip, peach, and cabbage.

22. COLOUR IN FLOWER OUTLINES.—This contest may extend over a long period of time, as a week. Divide into teams and no outline to be coloured in unless the flower is found and brought in by someone on the team. All colouring to be done from specimens.

23. ACORNICLE.—A game for four or less. Each player names his kind of acorn and gathers fifty. The ground or a piece of paper is marked off into 200 or more squares. The object of the game is to get five acorns of one kind in a row. (In five successive squares.) One player puts an acorn in any square. Each player takes a turn placing one at a time in an empty square. Opponents may be blocked by placing an acorn at the end of his row. The first one to get five in a row wins. A good game for learning the difference between oak acorns. May be played with twigs or leaves.

24. GETTING PARTNERS.—If in the beginning it is desirable to get partners it may be done as follows: (1). Cut leaves in halves, crosswise and lengthwise. (2). Give leaves to boys and fruit of same kind of trees to girls. (3). Give tree questions to boys and answers to girls. (4). Use bird characters, Mr. and Mrs. Robin, Mr. and Mrs. Downy Woodpecker, etc. (5). Give duplicate slips to boys and girls, having names of birds. Each boy imitates the bird by voice, walk, or flight. If the girl recognizes it as the one named on her slip, she claims him as her partner.

25. FLOWER FAVOUR GAME.—Use reeds for stems; coloured plasticine for receptacles; pine cone scales, feathers, shavings, or shells for petals; insert petals into plasticine. Sealing wax, dyes, paint, and enamel will be useful. Have a real flower as a guide and give a definite time limit. Judges choose the best.

26. SOCIAL-QUIZ. — Questions which give fun and knowledge. Good social mixers. May be used for amateur radio programme. Audience shows approval by saying "How, How" or disapproval by grunting. Each per-

son given a question in turn. Why can't a hen smile? What bird has eyes in front of its head as you do? What animal has been your most favourite companion? Like what bird does your left hand neighbour walk? Like what animal do you drink? Who drinks like a chicken? Who has a figure like a wasp? Of what animal does A's dancing remind you? Who has a backbone like a jelly fish? Who has a complexion like a Baldwin apple? What animal does your teacher call you? What walks like a duck? Like a pigeon? Of what sound in nature does A's eating soup remind you? Of what kind of an animal does B's ears remind you? With what animal do you prefer to converse? What sounds in the hen language do you understand? By what animal name would you prefer to be called? Who eats like a pig? Who laughs like a hyena? Who is a scarecrow? Who has the complexion of a lobster? This list may be elaborated. Which end of a horse, cow, dog, man gets up first? Which end of a cat or squirrel comes down a tree first?

27. SHADOWGRAPH.—Attach a white sheet as a curtain with a bright light behind it. Pass several objects behind the sheet so that a shadow is cast. Use such objects as a pine tree, horseshoe crab, cabbage, dog, turnip, rhubarb, leaf, pear, hen, goat, stuffed birds, pine cone, woolly bear, cattail, lily, lemon. Audience have a sheet of paper and write names.

28. STUNTS.—(1). Leaf throw. Throw a leaf as far as possible without folding or breaking. (2). Imitate the call of a crow or duck. Nearest wins. May decide by pointing to competitors and the one that the audience claps loudest for wins. (3). Who can make the best poem using the words rabbit, habit, white, fight. (4). Hop like grasshopper. (5). Make a speech on fishing.

29. NATURE "CROWS AND CRANES" OR "BLACK AND WHITE".—Divide the group in two teams and line them up facing each other in two lines some ten or twelve feet apart. Back of each line is that team's base line. One team is known as "True" and the other as "False." Make nature statements that may or may not be true, such as "Birds have teeth," "Bats have fur." If the statement is true, the true side chases the false side to its base line. Anyone caught enroute joins the true side. If the statement is false, the false side does the pursuing. At the end, the side with most players wins. It is well to have the statements written out on a card in advance so that you will not slow the game while you think of the next question. Be sure everyone knows the correct answer before you ask the next question.

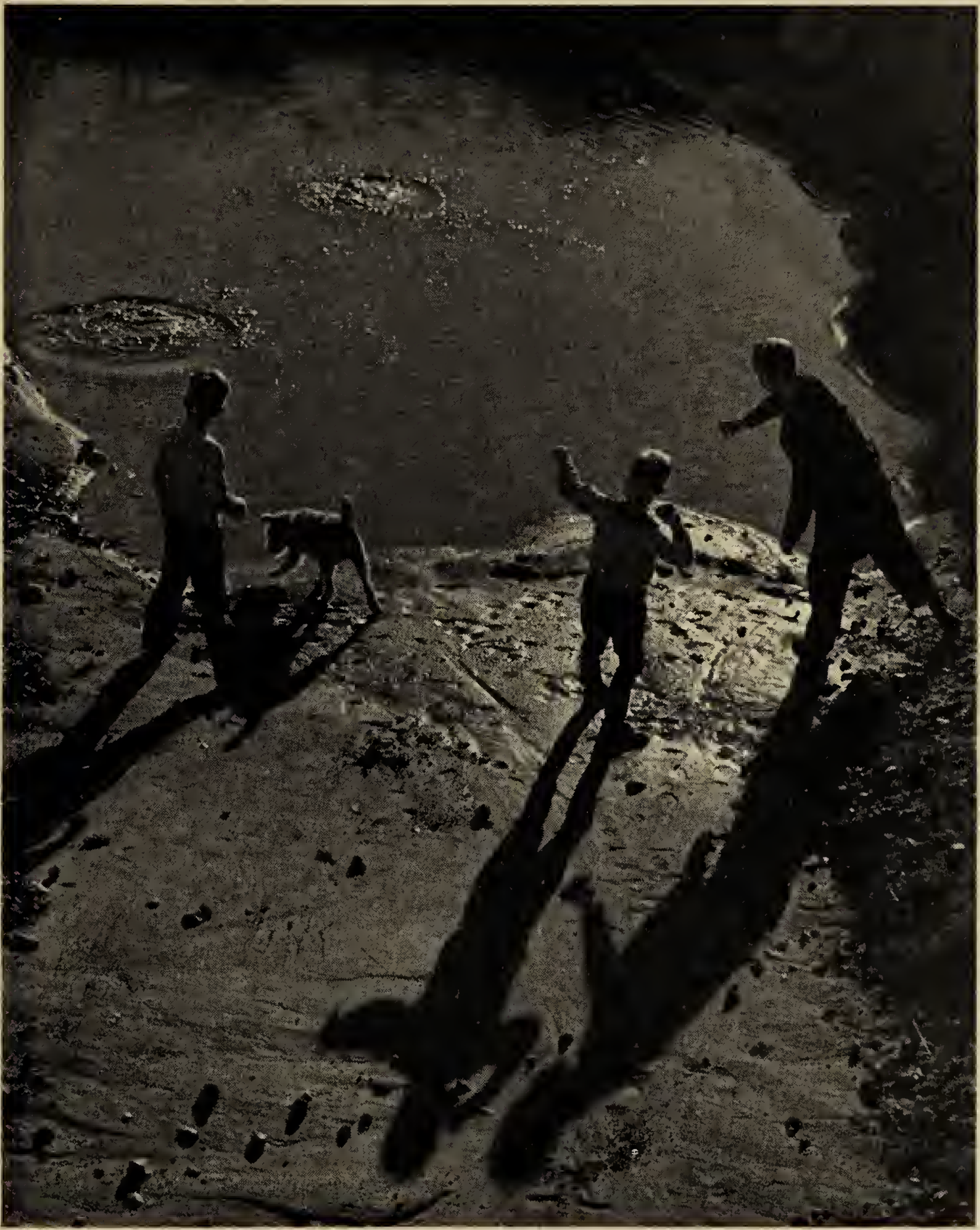
30. CONSTELLATION CONTEST.—Divide the group into two sections. Let each select a player to make the first constellation. Then announce the name of a constellation familiar to the group. It is to be made on the floor, using pieces of paper or pebbles for stars. The team whose representative makes the most nearly correct pattern wins a point. Another player from each team is then chosen to do the second constellation.

11. OUTDOOR GAMES

A. BIRDS

31. BIRDS' NEST JACKSTRAW.—The catbird's nest may be taken to illustrate this game. It should only be played with an abandoned nest. Before dissecting it, each player lays claim to the kind of material he thinks most abundant in the nest. It may be a hemlock twig. He has first claim on hemlock twigs but on no other. Take out a stick for example. The same is true for all the sticks, leaves, weeds, grasses, fine roots and strips of bark. Remove the parts one by one. In case someone recognizes a part as grass and no one else knows the kind, he is entitled to the specimens of that kind. Ten seconds, or a count to ten, is allowed for each to claim their kind of twig. In case it is not claimed by the one entitled to it the object is given to the next one recognizing it. Have the players count the number of each kind of material. Add five points for the naming of any one kind. The second part of this game consists of finding the source of material. The director of the game holds up a strip of bark which probably is that of the grape vine. After everyone has examined it carefully the reader blows a whistle and the first one discovering the nearest grape vine gets a point. This is repeated for each kind of material.

32. BIRDS' NEST TAG DAY.—This contest lasts all day and the best results are obtained when a good library is available. The camp is divided into teams. A tree having a nest may be tagged with a conspicuous card which must not be so placed as to frighten the bird. The tag must have the correct name of the bird proprietor of the nest. If



SPLASH! SPLASH! Fred Bauer, Jr.

Bauer's subjects were his own sons, who enjoy playing in a deserted gravel pit a few miles from home. This time they had talked him into taking them there, and Bauer followed them around all afternoon without photographic success. Then they started back toward the car and tarried for a last "fling," as he watched them from an elevation. When the grouping showed possibilities he improved it by verbal directions and the rocks were thrown time and again until he was certain that two splashes registered in the right places. He used Panatomic-X film, which was exposed 1/25 at f8. The Opal G enlargement was developed in Selectol and blue toned in Nelson's. Speed Graphic camera.

the member of any other team discovers that the nest is wrongly named it may be re-named and the first tag cannot be counted in the final score. Otherwise the nest is only to have one tag. A team discovering a nest and not knowing what kind it is may watch for the builder or investigate in the library. Other ingenious methods will develop.

33. SPOT SPY.—This game is great fun while resting on a hike or when loitering along the way. The leader says: "I can see 5 white oaks." The group are given one or two minutes to spot the white oaks. All those who see them may indicate it by sitting down, taking off their hats, or by some other agreed signal. All those who see the objects get a point.

34. SIGN LANGUAGE.—This game is similar to pantomimes. A player does the whole thing by the sign language. He may come out and point to himself. This means "I". He then flutters his hands like a bird. This means "I will fly like a bird." He may then imitate the flight of a swallow. It may be a hawk. He shows that it is not a swallow by measuring. He holds his hands apart the length of a swallow and shakes his head. He then holds his hands apart the length of a hawk and points into the air and with a sweeping motion of the hand indicates the spiral soaring of the hawk, and by signals shows a hooked beak and that the hawk is looking for the frog and when he sees the victim pounces upon it and eats it. The hand held over the eyes means "Look". Pat the abdomen and smile means, "That tasted good." Or the food might have given a stomach ache. This game gives an unusual opportunity for ingenuity. The one guessing the name of the bird gives the next pantomime.

B. TREES

35. TREE TAG DAY.—Give each player 10 tags with the names of ten trees common to the tag area. Give them 20 minutes to pin the tags five feet from the ground on the north side of the trees named. No tree is to have more than one tag. A greater number of tags may be given for an all day tagging. The one tagging the greatest number correctly wins. A second game of "Calling in the Tags" may then be played. A player may bring in any tag except his own. If he finds a tree incorrectly tagged he leaves it and on a later tour of inspection obtains two points if he can correct the mistake.

36. TREE SPYING.—Stop at a tree, such as the wild black cherry. Each one identifying the tree by use of the leaf chart within three minutes is given a point. For each mistake a point is subtracted. At the end of the trip add the scores and announce the winners.

37. TREE SCOUTING.—Appoint leaders to choose teams. Tell them to study the oak leaves on the chart and then at a given signal give two minutes to obtain a white oak leaf. The tree given should be known to be nearby. At the end of two minutes blow a whistle. Those back in their places with a white oak leaf (no more, no less) score a point. Next send them scouting for a red oak acorn, a balm-of-gilead bud, and so on. The team scoring the greatest average represents the group of best tree scouts.

38. FOREST GOOD TURN.—The Scout law, "Do a good turn daily", is well illustrated by this game. Give each group a few minutes to discuss the subject "Forest Good Turn." When the whistle is blown they are given 5 minutes to do a good turn. Each good turn is worth one point. To encourage originality, if no one else did that particular good turn it is worth two points. The team securing the greatest score wins. The reports are not the least important in this game. Some good turns are: Labelling poison ivy, destroying a tent caterpillar's nest, neatly cutting a broken branch, removing a tree fungus, concealing a rare flower, yet leaving it so that it can grow, cleaning away fire bait, picking up rubbish, burying broken glass, hanging out a piece of suet for birds, and planting the seed of a desirable plant. If each scout troop played this game once a year the amount of good accumulated would be inestimable.

39. A FOREST CENSUS.—This game is well adapted to a permanent or temporary camping site. Mark off a forest area as the "Outdoor Museum." Have a large number of sale tags such as used in a department store. Divide into groups called foresters, miners, florists, birders, etc. If there are a large variety of trees and a small display of minerals give each tree the value of one and each mineral the value of three. The naturalists are then given fifteen minutes to label and list the natural history objects under their department. In the case of birds it would be the evidence of the bird rather than

the bird itself. The reports around the council ring are instructive and often amusing.

40. TREE TRAILING.—Hide messages "en route" and send out companies 30 minutes apart. The messages may read as follows: Take the valley trail to the east until you see a large yellow willow. In an abandoned flicker's home there is a note. Read it carefully. This note may read: Within sight of this spot is a silver poplar. As far from that tree as it is high in the direction of the noonday shadow is buried a birch bark message. Please leave this scroll as you find it. Before sending out the trailers it should be announced that skill and not speed is the essential thing. The group following the farthest wins. The trail, therefore, should become more difficult as it goes on. Such a trail may be made more interesting and exciting if it follows a story. Possibly some pirates landed and hid some booty the night before.

41. HARE AND HOUND.—Instead of paper use leaves such as the chestnut leaf. This does not litter the country and is much more instructive.

42. TREE CRIBBAGE.—This may be played for a time when on a hike. One group may take one side of the road and the other the opposite or the points may go to the side recognizing the tree first. It should be limited to trees on the road side of the fences. Counting the number of legs on the right and left is fun and usually ends up when coming to a poultry yard or a cemetery. Sometimes it is stated beforehand, as a joker, that a pink rabbit or a white horse, seen first will count as five points.

43. TREE PANTOMIME.—Epoch 1. Have a person with calsimined cheeks, smoked glasses, cotton batting in ears, gloves on hands, adhesive over lips, and clothes pin on nose. Nothing in the environment makes any impression. Epoch 2. Meets a scout or woodsman. The woodsman teaches the greenhorn. He gets his eyes open, the cotton batten out of his ears, etc. He is now able to recognize trees by feeling, taste, and smell. Being in the woods becomes a delight.

44. PITCH PINE TAG. — Something like Puss-in-the-Corner except player cannot be tagged while touching a pitch pine, or some other agreed tree.

45. LEAF PASSING.—Choose a broad leaf. Players stand in rows. At a given signal the one in front passes the leaf overhead to the one behind who passes it between his legs to the next and so on, alternating over and under. The one at the back of the line runs to the front and the leaf is passed back again. This is repeated until the one who started in front is back again. If the leaf is torn or injured in any way the game is lost.

46. PROVE IT.—Players sit in a circle. The one starting the game says,—"From where I am I can see a grey birch." The next one says,—"From where I stand I can see a grey birch and a black cherry." The next player repeats all that the previous players have said, in exactly the same order, and adds another tree or bird. It may be limited to what is seen on one grey birch tree. If anyone doubts the statement he may challenge the speaker. Anyone caught drops out of the game.

47. OPPOSITE AND ALTERNATE.—The players are divided into two lines, one called "opposites" (refers to buds and leaves) and the other "alternates." They face each other. When the leader calls "opposite" all the players in that line run and tag a tree that has opposite buds or leaves, and the "alternates" try to tag them. Anyone tagged before he finds a tree of his own becomes an "alternate." The side having the greatest number of players at the end of a given time wins. The same may be played with annuals and perennials.

48. TREE JERUSALEM.—On a hike through the forest call loudly the name of a tree and give 30 seconds to claim a black birch. All those getting a tree in an allotted time get a grain of corn. The one getting the greatest number wins. Can add beaver by way of interest. Anyone seeing a man with whiskers hollering "Beaver" first gets 5 grains of corn or "double beaver", (whiskers plus moustache) gets 8 grains.

49. LEAF RELAY.—Line up in groups. Give each one at the head of the line a list of trees. At a starting signal the first player hands the list to the second player and runs and gets a leaf of the first tree on the list. When he returns with the correct leaf the second player passes the list to the third in line and runs for the leaf of the tree second on the list. The group getting the greatest number of leaves in a given time or which finishes the list first wins.

50. GRAND CHANGE.—Players are divided into four groups, as black oaks, red

oaks, chestnuts and elms. Players stand by their tree—no two at any one tree. "It" stands at the centre and calls elms. If the centre player calls forest, everyone is required to change, but must keep to their particular tree.

C. GENERAL

51. SCAVENGER HUNT.—Make a list of objects to be brought in—specific rocks, leaves, insects, seeds, four-leaf clover, and so on, and let small groups, each with a list and a bag, see how many of the objects they can find within a certain time. The group with the most wins. Be careful not to include on the list things that should not be picked. As a variation, ask for twenty-six objects, each beginning with a different letter of the alphabet.

52. SECRET NUMBERS.—As in a treasure hunt, place notes over the route of the game in park, playground, or wooded area. Each note has a number or gives directions for securing a secret number. (The securing of the correct number may be based on a nature observation.) If all observations are made correctly and all directions followed, the sum of the numbers secured should equal the number in the leader's hand. This game is very successful with large groups as well as small ones.

The following samples will illustrate types of questions:

1. This tree is white pine. The secret number equals the most common number of needles found in each bundle on this tree. The next note will be found at the base of the largest tree you can see to the south of this point.
2. This tree is a sugar maple. If the leaves of this tree are arranged in two's opposite each other on the twig, the secret number is 10. If the leaves are alternate and not opposite the secret number is 5. The next note will be found under the "skin" of a large stump. Continue south along the trail.
3. Each ring on a stump indicates one year of growth. If this tree was more than fifty years old when cut the secret number is 20. If the tree was less than fifty years old when cut the secret number is 10. Continue along the trail and look for the next note in the first drainage pipe under the trail.

Some things to keep in mind in conducting a game of this kind are: Use as many kinds of nature materials as possible—stones, trees, work of insects, flowers, bird nests, and so on. The best game for a group of beginners should be one in which very little actual knowledge is needed but in which success depends on keen observation. This game can be adapted to children or adults by increasing the difficulty of finding clues and making observations. Send players out in groups of four to eight. Emphasize the fact that accuracy, not time, is the chief element in success. Warn them to leave notes undisturbed for groups that follow. Appoint or have chosen a captain for each group and supply him with pencil and paper for the recording of numbers from each clue. Give the captain the directions to the first clue and explain the game to the group.

53. CURIOUS SHAPED ANIMALS.—This game is well liked by children on Nature Guide Trips. Give them five minutes to get a curious shaped animal. The scaling bark of the yellow pine is particularly well adapted to this use of the imagination. Drift wood and washed roots are suggested. Pine cones as the bodies of filli-loo birds, knots as curious heads, and berries used for eyes add to the fun. In camp it may be announced that there will be an exhibition that evening. It furnishes a good time for the day.

54. BLIND AS A BAT.—It is well known that a bat is not blind. Some people who are blind can see more than some people who are supposedly not blind. Blind the player with a neckerchief. Each player has a keeper who may have a string attached to the player to guide him. He is not allowed to carry on conversation. The keeper writes a list of objects given by the "blinded player". The one naming the most things correctly in ten minutes is the winner. The keepers may then take their turn.

55. ONE OLD CAT.—Have a home base, umpire, any number of fielders. The game is played with a volley ball or an indoor baseball. The batter hits the ball with his hand. He is out if a fly is caught or when hit with the ball. When the ball is hit the umpire calls the name of a plant, such as primrose. The runner has to get one of these plants to be safe. A fielder getting on one of these plants first makes it unsafe. The same plant cannot be named in succession. A run-

ner on a plant must change plants when the batter hits a fair ball. Fielders cannot hold the ball but must keep passing it. The umpire acts as pitcher and tosses up the ball for the batter to hit.

56. OUTDOOR SMELLING.—This is a continuation of the Indoor Smelling Game. To count, the object must be scented before being seen. It may be new plowed ground, a pine wood, new mown hay, a salt marsh, a dinner cooking, a forest fire, a stove coal fire, an underground fire, peat burning, a tar barrel, etc.

57. NATURE SOUNDS.—The group is given five minutes to see who can make the longest list of things heard in the woods during that time. It may be a raindrop, crow, cow, rooster in distance, rustling leaves of oak, or the swish of the pine, tapping of the woodpecker, or song of the brook.

58. DARK NIGHT ANATOMY.—Players sit in a line or circle. Pass out the parts of a cat. Use oyster for the liver, grape without skin for the eye, wet rubber tube for intestines, etc.

59. SEED DANCE.—The player who can keep a certain seed in the air longest, without using the hands, wins. Milkweed seed is good for this amusement.

60. EXPLORING GAME.—Parties are sent out to discover good blueberry picking, clay for pottery, frog's eggs for the aquarium, a good region for nutting, sphagnum moss, etc.

61. SAND TRACKING.—Make puzzles on the beach, such as: Someone has a piggy back ride, someone falls down and is helped up, someone crawls on hands and knees to view a bird, etc.

62. OBSERVATION GAME.—This is a game commonly given in scouting. It is allowed to take place in a store window. It is better to use common objects of the out-of-doors or even rare birds that should be known about. Allow to observe the colouring of the wood duck for example. After it has been written, read a description and have the players check off each point mentioned.

63. ALL ROUND SCOUTING.—This game is a real test of scouting. Group is divided into patrols. Tell them that this game is to see which patrol is best adapted to go into the woods and shift for themselves. First of all if they do not have matches they need something to make a fire. Show them a piece of flint or quartz that is in the neighbourhood. When all have had a good look at it give them one minute to get a piece. Everyone having a piece and back in place at the end of a minute is given one point. Next say that they need good tinder. If they bring back good tinder, such as grey birch bark, shreds of red cedar, nest of a mouse, give them one point. Next they must have kindling wood. It should be fine, dry, and preferably pine. Then they are sent for edible plants, such as have been found in the neighbourhood. The specimens must be shown each time. Milkweed for greens, pine knot for a candle, sumach berries for lemonade, maple sugar leaf to identify the sugar tree, poke weed leaf for locating starch food, nuts for fat, etc. They are given a minute for each. The patrol having the best average is best suited to roughing it.

64. THE PLANT GEOGRAPHY GAME.—There should be a library of good botany books, which tell whether certain plants were introduced from Europe or Asia, and their geographical range. The players are taught how to find this information. A native plant counts one point, a plant from Europe one point, and a plant from Asia two points. The contestants are given a day or two to make their collection. All assemble for the final reckoning. The plants that come from Asia by the way of Europe will count two points if the side presenting the plant discovers that its original home was in Asia and only one point if they say Europe. They will discover that the majority of plants introduced from Europe are weeds. Some interesting "whys" result from this game.

65. FORAGING EXPEDITION.—This is a game of life which is played by all animals. Civilization has made it impossible for most people to play the game, successfully. Have edible plants count one point, medicinal plants one point, and plants useful in the crafts one point.

66. SPELLING BEES.—Divide players into groups. Play the game with fall flowers, insects, or trees. Hold up a fall flower. The first in line must name it and give an interesting fact about it. If he fails he drops out of line. The side having the greatest number remaining wins. It is better to commence with the commonest and well-known plants.

67. INTELLIGENCE TRAIL.—This is one of the few trail games where time as well as intelligence may be the important factor. For example: Trail starts at a granite boulder.

If this granite has:
mostly pink feldspar—
go SSW 16 paces to a grey birch
considerable hornblende—
go NNW 10 paces to a grey birch
no black mica—
go N 20 paces to a red maple
over 50% fine grained quartz—
go S 15 paces to a sassafras

The next station is the red maple. If it has:
bark resembling beech—
go E 12 paces to an elm
alternate leaves—
go E 24 paces to an elm
leaves with the same shade of green above and below—
go W 18 paces to a red maple
twigs with strong odour when crushed—
go W 30 paces to a smooth sumach

The next station is an elm. If this tree is:
over 125 feet tall—
go NNE 20 paces to a woodchuck hole
less than 50 feet in crown spread—
go SSW 30 paces to an ant hill
4-5 feet in diameter—
go SE 38 paces to a coral mushroom
has leaves averaging over 6 inches in length—
go NW 17 paces to a limestone boulder.

(To get the height of a tree sight it with a pencil held vertically, at arm's length. Turn the pencil to a horizontal position and locate a corresponding distance from the trunk and on the ground. Pace off this horizontal distance.)

68. BEST CURIO COLLECTOR.—Played with a group walking through the forest. Name the curio and crowd scatters to find it. The one discovering it first gives a war whoop and others gather around him. If he is successful that is the starting point for the next. Send for such things as the following: A hump back tree, a tree struck by lightning, a tree with last year's catkin, a tree with scale insects on it, a tree infected with galls, a tree with branches on one side, last year's fruit stem, a tree with moss on the north side only, a tree with lichens on the south side, a tree that has a stone in the centre of the fruit, a deciduous tree that has cones, an evergreen tree that does not have cones, a red maple that has had fruit, a red maple that has not had fruit, a twig that took ten years to grow an inch, a twig that grew ten inches in a year, a twig that grew 36 inches or more in a year, see who can find the oldest twig five inches long, a sumach bush five years old, a rock with a quartz vein, a tree with a rock callous, where a woodpecker has been feeding, a woodpecker's home, the work of the sap-sucker, a feldspar crystal, pine pitch enough to fill a thimble, fruit of the ash tree, a mud dauber's nest, a leaf miner's home, nuts gnawed by a squirrel, an owl's pellet, evidence of a rabbit, a robin's nest, an animal footprint.

69. SENTINEL AND MARAUDERS.—A game adapted to rest hour on hike. Seat one patrol in a circle with individuals at least ten feet apart. Cut shrubs three feet high and stick in ground five feet in front of each number of patrol. Blindfold with neckerchiefs. A judge stands in the middle of the circle. The second patrol is given 10 minutes to steal into the circle and get a shrub and walk away with it without being detected. The seated patrol, or sentinels, when hearing a footstep, twig snap, or unnatural rustling of leaves, points in that direction. Any marauder pointed at in this way is eliminated. The judge indicates this by a wave of the hand. The eliminated individual must go to the auditorium, some 60 feet away, decided upon before the game starts. The score equals the number of shrubs taken out of the circle for at least a distance of thirty feet in the ten minutes. The Sentinels and Marauders exchange positions. The team securing the greatest number of shrubs in 10 minutes wins. Dead twigs and dried leaves may be placed around the circle or it may be played amongst a thick growth of shrubs. This game develops great skill in stealthiness.

70. SOUND LOCATOR.—A good woodsman can locate a sound quickly both as to direction and distance. As a preliminary training have "It" stand back to 10 or 12 people. No person to be nearer another than 10 feet. A leader points to some one who whistles. "It" turns around quickly and names the one who whistled. If correct the whistler takes his place or the best average for 10 trials. Out-of-doors this may be tried by rustling autumn leaves on the ground, by wading in water, by jumping in sand, by dropping a stone, a few feet away and having the person identify the stone, by snapping a twig, by taking three steps, etc.

71. FIREFLY TAG.—Played when it is dark. A fast runner is provided with a flash light. He must give occasional flashes. Pursuers must tag the runner. Whoever catches him becomes the firefly.

72. SHELL DIVERS.—The diver scores the number he brings up at one dive or different values may be given to different kinds.

73. PINE CONE BASEBALL.—Use pine cones instead of baseball. The pitcher throws a cone at the batter. If the cone hits the batter a "strike" is made. If not, it is a "ball". Count strikes and balls as in baseball. The batter may hit the ball. If it is a fair hit he becomes a base runner. Runners may be put out between bases by being hit with the cone in play. Players cannot run with cones. The batter may catch the cone and throw it into the field.

74. GALL TEST.—The players try to collect the greatest number of galls in a given time. One point for each kind obtained and one additional point for each one identified. For identifying one may use E. Laurence Palmer's booklet.

75. TRAIL OBSERVATION.— A good scout can retrace a trail because he remembers certain objects along the trail. Walk for a certain distance over a trail and then ask ten questions or each one may write ten questions and then exchange. Arguments will follow and it will usually be necessary to go over the trail again. Various objects may be placed along a backyard walk. They then return to the house and are given a pencil and paper to list what they saw.

76. THE BALANCE OF NATURE.—The hunter traps the skunk, the skunk eats mice, the mice eat bumble bees, the bumble bees assist the clover, they may sting the cow, the cows eat clover, the hunter drinks milk. The skunk is safe in a hole in the ground. In the game it may range from an ant hole to a hole of the ground hog. The mouse is safe in a hollow tree or in an abandoned bird's nest. The bumble bee is safe under a stone (standing on stone). The cow is safe under a tree. The clover may receive a friendly visit from the bee or be nipped by the cow. The hunter is safe at home. At a given signal the struggle for existence begins. Anyone tagged by his particular enemy —when away from his safety, becomes that animal. The game may be ended by saying that after a given signal anyone tagged becomes *hors de combat* and is out of the game.

77. SENSE OF DIRECTION.— Greenhorns get lost going to the woods and bragnuts when they try to get them out. Zigzag a group through a forest and then have them try to go straight back to camp. This is not a running race. Everyone is expected to walk. The one getting back first may have gone on the most direct route. If a fire tower is at hand the leader may check up or all scouts may point toward camp and one climb a tree and determine the winner.

RACCOON

SECTION FOUR

Nature Teaching Can Be Nature Adventuring!

ELIZABETH H. PRICE

We all agree that primarily we are trying to kindle a flaming interest in a world of living things. We are trying to develop an awareness of their surprising and fascinating behaviour, a deep, enriching appreciation of their beauty and wonder that will grow with the years till it becomes one of the major sources of a rich and rewarding joy throughout life.

If we could ban from our thinking as well as from our vocabulary the words "teaching nature study" and substitute for them "nature adventuring" and make it a gay, personal adventure in discovering a living world, we'd get much better and much faster results.

We must not present dry, bookish facts, and require children to learn names of things in which they are not interested. Instead, let's introduce them to a world that is excitingly alive and fun to watch. Use a book-fact only as a springboard from which to dive into an adventure of seeing-it-for-yourself, and seldom tell the name of anything till the child has discovered so much interest about it that he truly wants to know it; can't stand not knowing it.

Let's not keep a group of children close about us on the trail, ladling out information. Plan gay quests and send the children scampering to find things. It's child nature to like to feel free, to run, and hunt, and find treasures, and then come back and show them.

In the schoolroom, have a lavish abundance of living things comfortably housed and conveniently displayed for observation. Then throw out such intriguing questions that the children will be impelled to watch and find out the answers for themselves.

Few children are fluent enough in self-expression to enjoy writing compositions, so a required write-up of an adventure often completely dampens a joyous experience. Let's not do anything that takes the fun out of a nature adventure.

Once you've kindled their enthusiasm to a leaping flame, you'll have to run very fast indeed to keep up with them, so avid will be their eagerness for more and more knowledge.

So—let's not "teach nature study"; rather, let's go nature adventuring; let's watch living things live. Try these methods in the following twelve articles which we have found eminently successful. The articles are arranged chronologically according to a theory of evolution.

THESE twelve articles by Mrs. Price are a happy introduction to teachers and youth leaders. They are written in a colloquial style with many stimulating ideas for activities to generate interest and appreciation rather than to give facts and information. Using this material with imagination and skill will ensure a response that will arouse children, youth, and adults to a new awareness of the joys of the world of nature.—*The Editors*

Astronomy

For you who have discovered the joy of sharing, there are few, if any, projects that surpass in splendour that of making the sky your own and then giving it to others. One does not feel apologetic about sharing the sky, with all its sparkling loveliness, its awe-inspiring grandeur, its ever-changing beauty.

In my own happy sharing of the sky, I enjoy "drawing out" of my pupils what they already know, and building on that, avoiding statistics and complicated technicalities, but suggesting non-technical things to watch for that yield such startling surprises there is never a dull moment.

Myths

Interest can be developed by telling the always popular Greek myths and Indian legends connected with the constellations, but don't let the pupils expect to see clearly the figures of the people and animals concerned. Draco is a beautiful dragon, but who can make a Queen Cassiopeia out of a W or an M?

A Jolly Way To Begin

My favourite start-off is to ask a group, "Who knows the name of the nearest star?" It's the sun, but few of them realize it. Then, "What's the name of the nearest planet?" After they have argued over Mercury, Venus, and Mars, I throw at them with a laugh, "You're sitting on it, it's the earth" and suggest they catch their families on the same questions at the dinner table that night.

Then on the basis of what they know about the sun and the earth we launch into a free-for-all discussion of the difference between stars and planets and wind up with these points clearly in mind:

Stars are huge, planets are comparatively small.

Most stars are extremely hot, planets are cold, except as heated by the sun.

Stars shine by their own light, planets by reflected light.

Stars are infinitely far apart; the planets, all children of the sun, make a cozy little family, comparatively close together.

Next comes the conundrum, "When is a star not a star?"

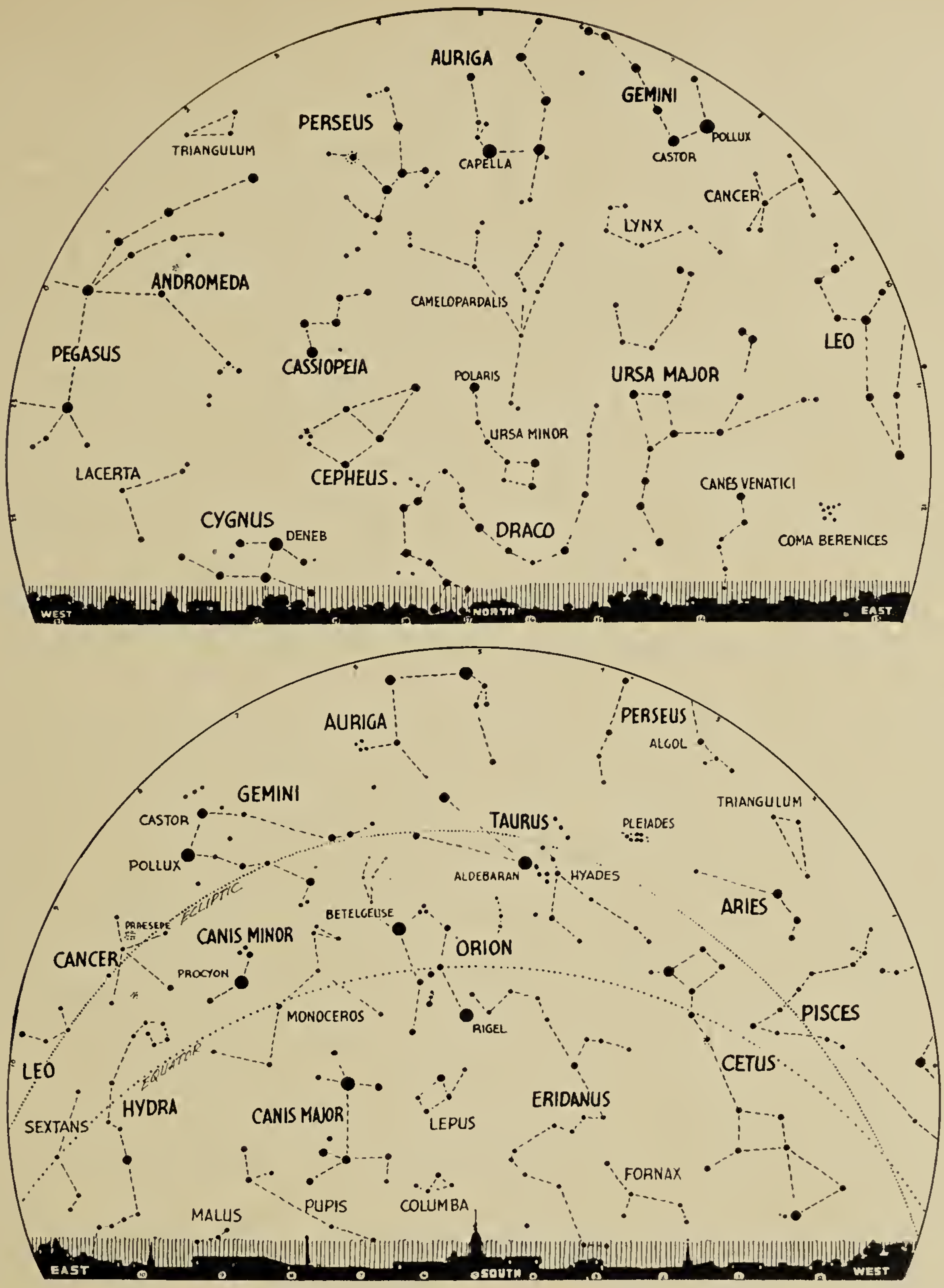
The answer is, "When it's a 'morning star', an 'evening star', or a 'shooting star' ", none of them stars, but all called stars. The first two are planets visible in the east in early morning, or in the west in early evening, and the third is a meteor.

It leads at once to a discussion of meteors and the fact that space is cluttered with much gravelly rubbish, usually stone or iron, or iron and nickel, thought left over when the planets were formed from the sun, or lost from the tails of comets. Each, little or big, cold and invisible, travels on a path of its own about the sun, and only if it passes through the earth's atmosphere is it heated to incandescence and looks to us like a star falling. Real stars don't fall, they can't. Most meteors are so small they burn to ashes before they land on the earth. Some larger ones, fire-balls, explode with the heat. Any that land on the earth are called meteorites. Full of interest to the older children is the tale of the largest meteorites ever found and placed in museums. On nights of famous meteoric showers (when the earth is passing through the lost tail of a known comet) it is grand fun to watch and count meteors.

The Earth's Motions

At another session I ask, "What causes day and night?" Nearly every one knows it is the turning of the earth on its axis (rotation), not the actual moving of sun, moon, and stars across the sky as the ancients believed. Use an apple skewered on a pencil at this point. Visual demonstrations are so much more easily understood than words. Here you are on the surface of a large globe which is spinning round on its axis, i.e., spinning like a top, and carrying you with it. This makes the stars appear to be going in the opposite direction. Turn yourselves around and try it. You meet with a similar deception when travelling in a train. If you have been reading, and look up suddenly, it really seems, just for the moment, that trees and houses are flying past you.

Next, "What makes a year?" "One complete revolution of the earth about the sun." "How long is a year?" "About 365¼ days." "What has been done about that quarter day?" "An extra day has been added to one year in every four and this is called Leap



THE WINTER STARS

To use these maps, face north to see the sky as shown on the upper chart. Face south to use the lower map.

Year. The century years are not leap years unless they are divisible by 400." "Was 1900 a leap year? Will 2000 be one?" Don't tell them any of the answers they can work out in group discussions.

SEASONS

Then there's the matter of seasons caused by the tipping of the earth's axis (apple on pencil again), not by our distance from the sun. It surprises most children to learn the earth is nearer the sun during a northern winter than it is during a northern summer. In the southern hemisphere, where seasons are reversed, people are nearer the sun in summer and farther away in winter.

PHASES OF THE MOON AND ECLIPSES

Another important problem to work out visually is the matter of phases of the moon and eclipses of the sun and moon. There isn't space to go into that in detail here, but it is made clear in every astronomy textbook. Use lively diagrammatic demonstrations.

EVER THINK OF THIS?

It is great fun to discuss with the children how the sky looks and behaves from different viewpoints on the earth. First, imagine yourselves sitting at the north pole in midwinter, when the sun never rises. The North star is directly overhead, and you can see all the stars north of the celestial equator. Rising and setting? No! Each star seems to travel in a path parallel to the horizon in a steady twenty-four hour merry-go-round. Then hop to the equator to warm up. There the North star is on your north horizon, the south pole star (if there were one—they're all very faint around the south pole) would be on your south horizon. Days and nights are each twelve hours long and every star in both hemispheres would be visible if the sun, by day, didn't dim them out, and every one seems to rise, cross the sky, and set. Quite a contrast to the polar situation. When we return home we find a mixture of the two. The circumpolars (constellations between the North star and the horizon at your latitude) seem to revolve around the North star every twenty-four hours, neither rising nor setting. All other stars appear to rise and set and you can see stars as far south of the celestial equator as you are south of the north pole.

PLANETS

The planets are rich in interest. Let the children name all they can and tell which are visible to the naked eye. Mercury can be seen if you know when and where to look. It is always so near the sun it is dimmed by twilight and horizon haze. It is a feat to catch sight of it! Share with your pupils the more exciting stories about the planets instead of statistics or technical details. The discovery of the planets not visible to the naked eye, Uranus, Neptune, and Pluto, is one of the most dramatically interesting tales in all astronomical history.

Adventuring with Stars

FIRST it is essential to make that part of the sky which you plan to share with your pupils your familiar friend. The excellent sky-maps in *Canadian Nature* will make this easy, and when you come to share it a strong focusing flashlight is worth its weight in gold for its beam makes a perfect pointer to the star or constellation in question, much better than a finger or extended arm. It points for everyone in the group, not just for one.

How many stars would you guess you can see with the naked eye at any one time on a clear moonless night away from city lights? Most people will guess millions. There are scarcely 2,500. Hard to believe, isn't it?

At once you will notice how they differ in brightness. The very brightest are called first magnitude stars, magnitude meaning not size but apparent brightness; one realizes that a nearer small star could look brighter than a more distant larger star. A good beginning in knowing the sky is to master all the constellations with first magnitude stars visible in your latitude.

You'll delight in the different colours of stars. Did you realize stars are born as red giants, then go through orange, yellow, and white stages, some attaining the climax of a blue-white, then decline through yellow and orange till they reach red dwarfdom and finally are dark and dead and cold? The red giants, like Betelgeuze in Orion and Antares in Scorpio, are about 300,000,000 miles in diameter, so big that our sun and enough of the solar system to include the orbit of Mars would find ample elbow room inside either one. They are hundreds of times less dense than air. By contrast the bright dog star, Sirius, has a companion called the Pup which is so dense a thimbleful would weigh a ton. Imagine being able to weigh stars and measure their diameters when they are so far away not even the most powerful telescopes can make them out as anything but a point of light!

When I was a little girl we supposed our world (including all the stars that we could see) was all the universe. Since then, through the use of larger telescopes, astronomers have discovered over a million more stars, and know that the spiral nebula in Andromeda, visible to the naked eye, is part of another world. You'll not want to miss seeing that. Get someone to point it out to you. It takes a million light years for its light to travel to your eyes.

In all the excitement of extending our discoveries of the breath-taking universe, never lose sight of its surpassing beauty. The poets help there.

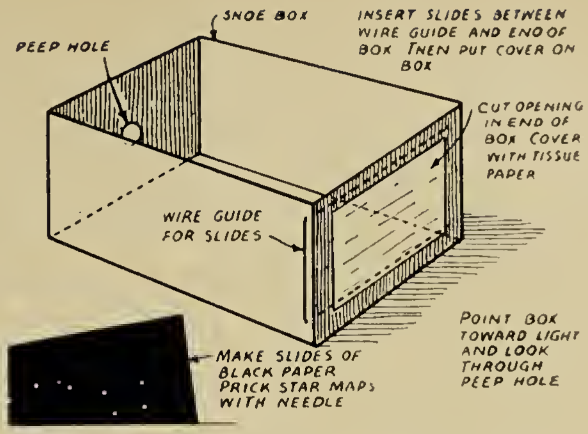
"God is at the anvil, beating out the sun;
Where the molten metal spills,
At His forge among the hills
He has hammered out the glory of a day that's done.
God is at the anvil, welding golden bars;
In the scarlet-streaming flame
He is fashioning a frame
For the shimmering silver beauty of the evening stars."

—*Lew Sarett*

In the back numbers of *Canadian Nature* there is a wealth of interesting, simple, astronomical material.

How to Make a "Star Gazer"

THE diagram shows how to make a shoe box into a "star gazer". An opening is cut in one end and a small peephole in the centre of the other. A wire guide about ⅛ inch from the open end holds the slides in place.


SHOE BOX
PEEP HOLE
INSERT SLIDES BETWEEN WIRE GUIDE AND END OF BOX THEN PUT COVER ON BOX
CUT OPENING IN END OF BOX COVER WITH TISSUE PAPER
WIRE GUIDE FOR SLIDES
POINT BOX TOWARD LIGHT AND LOOK THROUGH PEEP HOLE
MAKE SLIDES OF BLACK PAPER PRICK STAR MAPS WITH NEEDLE

Slides can be made of thin cardboard, with pinholes to represent the stars. Charts can be traced on cardboard cut to fit into the guides of the box. The sizes of the dots represent the brightness of the stars; try using a large darning needle or bodkin to make the holes for the bright stars, and a fine pin for the fainter stars.

To use the "star gazer" put a slide in the open end, put the top on the box and look through the peep-hole at a light. The "stars" will shine out and show how the constellation appears in the sky. Remember that the positions of the constellations in the sky change as evening advances and also with the season; you may have to turn your "star gazer" to represent the position of the stars as you see them in the sky.

Rocks and Earth Surfaces

IF anyone in the world should be interested in rocks and earth surfaces, we in northern North America should be and for three reasons.

1. We have the largest surface exposure of the oldest rocks in the world, two million square miles of them, lying in a giant horseshoe around Hudson Bay from the Arctic Ocean to the Great Lakes and St. Lawrence River and spilling over, here and there, into the United States. To find these most ancient rocks elsewhere, you have to burrow into the core of mighty mountains or descend to the bottom of such a vast canyon as the Grand Canyon of the Colorado. In molten form they broke through the earth's crust first, before there was any plant or animal life, and spread out in an enormous blanket. This cooled and was weathered and worn down; its debris, washed into the sea, formed *sedimentary* rocks which were in time uplifted to form dry land. Then more molten rock pushed up into both the older and the later overlying rocks and through heat, pressure, folding, and much distortion changed them both into *metamorphic* rocks. It was probably this secondary *igneous* out-pushing that formed the Laurentian Mts. Originally higher than the present Rockies, but now, after millions of years, worn down to the present rather low Laurentian Hills.

Can you imagine any "rock hound" who wouldn't crave a piece of these ancient rocks to start his collection?

2. These ancient rocks are extraordinarily rich in minerals and very valuable ores, as witness the iron and copper ores in the Lake Superior region and the nickel mines near Sudbury, Ontario, that produce over four-fifths of the world's nickel. Write for a bulletin from your Department of Mines for a bird's eye view of treasures you haven't dreamed of—and suggestions for additions to your collection.

From the National Museum at Ottawa you may purchase three or four different collections of rock chips and minerals named and in a cabinet. The least expensive one is 50c. In the United States, write to Ward's Natural Science Establishment, Inc., Rochester, N. Y.

3. Northern North America was covered by the largest ice blanket in the world during the Ice Age. That area exceeded our ancient rock area—think of it—four million square miles—and reached as far south as the Ohio River. It is believed to have been a good 10,000 feet thick in the Hudson Bay region, covering high mountains, and as it flowed relentlessly on its way, as all glaciers do, it gouged, scoured, scraped, scratched, picked up rocks in one place and dropped them in another, sometimes hundreds of miles away. Look for evidences of glaciation in your vicinity. Piles of rocks and gravel frequently dammed streams and caused lakes to form. Rocks scratched or polished by a glacier shout for a place in your collection. It should be fun for a child in New York or Illinois to find in his back yard a rock brought down from Canada by this ice giant so long, so very long ago!

This Ice Age wasn't continuous. It was interspersed with warmer periods when the glacial blanket receded toward its source or melted away entirely. Quite strange and hard to believe is the fact that our continent was much warmer than it is now for a long period before the Ice Age; tropical jungles flourished well into the Arctic Circle, with giant tree ferns, horsetails, relatives of our lowly club moss, and many other plants that love warmth and moisture. Hunt for fossils of these to enrich your collection.

Now that we've discovered what exciting material there is to work with in northern North America let's go back and make a more orderly beginning. We have spoken of igneous, sedimentary, and metamorphic rocks. It's time we defined them.

Igneous Rocks

Igneous rocks came first as fiery-hot molten material boiling up and bursting through the crust of the cooling, shrinking earth.

If the molten mass comes to the surface and cools fast, the minerals which compose it do not have time to arrange themselves in their characteristic crystal forms and the glassy, non-crystalline rocks, like lava result. If, perchance, the molten mass does not reach the surface, as is often the case, it cools so slowly that crystals do have time to form and we have such rocks as granite. The study of crystal forms is fascinating. You may experiment with crystal formation yourself next time you make candy at home. When you make toffee, you cool it very quickly, pouring it almost as soon as it's cooked, and it looks quite glassy, just as does lava. If you make fudge, you let it cool for a while before you beat it and pour it. Small sugar crystals form and the candy is nice and smooth. If, by chance, you let it cool by itself too long before you beat it, however, the process is too slow, large crystals form and the fudge is granular. The last two cases may be compared with the formation of rocks fairly close to the surface where cooling takes place at a moderate rate and deep in the earth where rocks of much larger crystals form.

Sedimentary Rocks

Igneous rocks cooled and were weathered by alternate heat and cold, rain, wind, freezing and thawing and the particles were washed into the seas where they piled up thousands of feet of sediment on the ocean floor and were finally packed or cemented into solid rock. It's difficult to realize that the land and sea areas in the world have kept rising and sinking. The oceans covered one vast section, then another, some land sank beneath a sea, other land rose out of it. And this is still going on but so slowly it isn't noticed very generally. Wherever you find sedimentary rock, visually that land has lain at some time deep beneath water, with the minor exception of wind deposited sediment.

There are three kinds of sedimentary rocks which intergrade more or less with each other. 1. Sandstone, made chiefly of coarse

quartz grains, 2. Shale, made of the finer grained clays and muds, 3. Limestone, made largely from the shells of tiny sea-dwelling creatures. Collect samples of each.

Metamorphic Rock

The earth has never been at rest. It keeps shrinking and quaking, new molten masses keep forcing their way up into older igneous or sedimentary rocks, heating them, bending or tilting them, exerting terrific pressure, and altering them almost beyond recognition.

Granite, which has been thus changed, is called gneiss (pronounced nice), sandstone becomes quartzite, limestone becomes marble. What fun to have a sample of each of these in your collection! Hunt for them on your next hike.

See For Yourself

To make this subject become very much alive, visit mines, foundries, reducing furnaces, jewellery stores, hardware shops, etc., to see what man does to rocks and minerals to prepare them for your use. Find in road cuts or along cliffs evidence of tilting, or folding, or other contorting of rock strata. Especially watch for evidence of erosion, in fields, road beds, road cuts, hillsides, and stream banks, and discuss repeatedly the tremendous importance of plant life in halting or preventing erosion.

Find places where new deposits are being made, as a sandbar at a river bend. When running water is slowed it drops the heavier particles it is carrying along.

Hunt for fossils of plants and animals in sedimentary rocks. Why wouldn't you find any in igneous rocks? What would be the likely fate of fossils in metamorphic rocks? Why can you often find fossil sea shells on dry land, even on high mountains? Try to find some to add to your collection.

Where to Collect

Good places to collect specimens are ex-

cavations, mines, mine dumps, quarries, roadcuts, bases of cliffs, and rock out-crops. Test rocks you find for hardness. What kinds of stone did the American Indians use and for what purposes?

EVERYDAY ROCKS AND MINERALS

To arouse student interest in rock study see how many different kinds of rocks are used in the buildings in your home town and secure examples of each. Then see what a long list you can make of minerals you encounter in daily life. Find out about the various alloys in common use.

Adventure in Magnetism

THIS is a gay adventure indeed—packed with surprises before you are through. Don't use the frail toy magnets you buy in stores, but get a large, powerful one a garage mechanic will gladly give you from a dismantled automobile magneto. He will also give you a handful of iron filings and that is all the equipment you need. I had thoughtlessly assumed that magnetism would act more or less like electricity and could not operate through any substance that is a non-conductor of electricity. How fast I learned otherwise! And how we scurried through the house to find more and more substances to test!

You might start with a pane of glass as thick as you can find. Scatter a few iron filings on top and move the magnet about on the under surface. It is highly amusing to watch the filings stand on end on top of each other and move about as you move the magnet. Don't bother young children with "lines of force" and other complex matters. Just have fun discovering as many substances as possible through which magnetism is effective.

Lay some sheets of paper on the glass. How thick a pile of paper proves too much for the magnet? How thick a board? The two thicknesses of a rubber hot water bag or the leather of a heavy shoe don't stop mine. Put some filings in a child's palm and the magnet under the back of the hand. The only thing we found that was negative to magnetism was a painted tin tray, not because of the paint or the tin but because of the iron base under the tin plating.

Let the children scamper about in search of all imaginable substances to try out. Good hunting and good fun, all!

Introduction to Plants

We've played about among the stars, found our way around in the solar system and we've been thrilled by the wonders of the rock surface of the earth on which we live, but exciting as that was, there was no life in it. We come now to the greatest miracle of all, the beginning of living organisms.

The First Plants

The first plants (and animals) were quite certainly tiny, one-celled blobs of living matter—protoplasm—the substance of which all plants and animals are made. And they doubtless occurred first in warm, shallow, sunlit water, for at first there were no devices to protect against drying out in the air or extremes of temperature. It is more than likely their first appearance was in pre-Cambrian waters but because of their lack of hard parts they would leave little trace as fossils and anyway you remember how those rocks were repeatedly distorted and transformed. From Cambrian times on for over five hundred million years the rocks have carried a fairly complete fossil record of the increasing complexity in plants and animals.

Plants Before Animals

Think of some of the things you have had to eat today. Oatmeal? Carrots? Potatoes? Roast beef? The first three foods are parts of plants and the last, the roast beef, came from an animal, the steer. But, to provide fine beef, the steer ate grass and other green plants. Think of some other *food chains* and find pictures to illustrate them. You can

1.

2

3.

4

THE ENTIRE plant kingdom is usually subdivided into four great divisions. (1) seaweed and (2) toadstool (gill fungus) both belong to the lowest division having no roots, stems or leaves. (3) Common liverwort and (4) sphagnum moss represent the second division also lacking roots, stems and leaves but having more complex reproductive structures. The plants in these four pictures have no tubes or vessels for carrying liquid food around the plant and are called therefore non-vascular.

LOWER PLANTS

5.

6

7.

8

HIGHER PLANTS

THESE PLANTS have tubes for conducting liquids to all parts of the plants and are called vascular. (5) Common wood fern, represents the third great division which includes ferns, club mosses and horsetails all of which have true roots, stem and leaves. The others belong to the fourth and highest division distinguished by plants which produce seeds. (6) Douglas fir has naked seeds and (7) Wild lily-of-the-valley and (8) Hepatica have covered seeds or fruits.

easily make a longer one than this next example: "The cat ate the mouse that ate the cheese that came from the cow that ate the grass that grows in the meadow". Animals require, as food, plants or other animals that have eaten plants. They can't manufacture food for themselves out of inorganic matter as plants can do. Plant life made its appearance before animal life.

Leaf Green

There is a magic substance called leaf green or chlorophyll in green plants (usually) that can harness the energy of sunlight, break up the carbon dioxide of the air, give back free oxygen to the air, mix the carbon with the mineral salts and water brought up from the soil, and make starches and sugars to feed the plant. No animal can do this.

Divisions of the Plant Kingdom

What a variety of plants there is! Some are tall trees; others are low growing shrubs or herbs; some have beautiful flowers and produce seed; while others, like the ferns, produce no flowers at all but reproduce by tiny structures called spores; some live on land, others in water; some are giants, while others are so small as to be seen only with a microscope. These wide differences led botanists years ago to attempt to arrange plants into different groups for study and discussion.

The first and lowest of these divisions is made up of plants that have no roots or stems or leaves. Many of these consist of but a single cell or colony of cells and all of them are relatively simple in structure. Many like the seaweeds and pond scums live entirely in water. Others like the toadstools and mushrooms grow on dry land or on dead logs or dead animal matter. Here belong all the bacteria. These organisms live in the soil, on decaying animal or vegetable matter or in other living organisms where they sometimes cause serious diseases. All the fungi, examples of which are the bread moulds, yeasts, toadstools, smuts and rusts, belong to this group. In general, the division is made up of the simplest forms of plant life.

The second division of the plant kingdom is composed of plants which also lack roots and stems and leaves in the sense that we think of these structures in more complex plants. To this division belong all the common mosses and their relatives the liverworts, both of which are found living in moist places or in water.

The third great division of the plant kingdom is made up of the ferns and their close relatives like the clubmosses and horsetails or scouring rushes. They differ from the two lower divisions in that they have true roots and stems and leaves and from the higher plants in that they do not produce flowers, fruits and seeds. In the fourth and highest division are the seed bearing plants. It is to this group that all the crop plants belong as well as the trees, shrubs and flowering plants with which every one is familiar.

We'll start you off on adventures with plants in each of the above groups presently, but, before you start out on your plant adventuring, be sure to consult the proper authority as to what plants are protected by law and must not be picked or dug up at all or only sparingly. A teacher or camp counsellor can usually get permission to pick and press specimens carefully which can be used by the entire class, indeed many generations of classes, for driprinting. A fern frond or pinna will serve for many inkprints if handled carefully. Fresh, not pressed, ones have to be used for inkprints, so they last just the one session. Above all, on your trips, preserve beauty, don't trample it underfoot.

Non-flowering Plants

ARE you all set for adventures with the nonflowering plants? Take your children into the woods again and again to see as many of these beautiful things as their sharp eyes can find. Among the things I checked in the helpful booklet, *Native Ferns,* that are special fun to look for, are; the different shapes of sporefilled capsules on mosses; the little umbrellas on Marchantia liverworts; the odour of the fragrant ferns; the different shapes and positions of the protective covering of the wee packages of spores on fern leaves—not overlooking the horseshoe shaped sori of the Lady Fern; ferns that have separate fertile spore-bearing fronds; the ferns that economize on these coverings by using the reflexed margins of the leaflets and the still more economical Polypody that puts its packages of spores to bed without any covering at all; the deep magenta colour of the not yet uncoiled fronds of the Maidenhair Fern and the purplish black of its mature stems; also the stem colour of other ferns having wiry, shining stems like the Maidenhair's; the just-beginning-to-uncoil fiddlehead crosiers of different ferns, every tiniest part of which is in-coiled; the odd ones like the Grape Ferns, the Adder's Tongue, the bulblets on the Bulblet Bladder Fern, and of course the Walking Fern. The bright cinnamon coloured fertile fronds of the Cinnamon Fern intrigue me as do the silvery white sori of the Silvery Spleenwort. You will want to visit all the evergreen non-flowering plants before the others have commenced growing again in the spring. These aren't half the things. I leave you the fun of finding the others for yourselves.

Habitats

To help me find the ferns, I listed them by habitats: 1. Those bold enough (and drought resistant enough) to thrive along road-sides and in dry meadows. 2. Ferns that can grow on fallen logs or that prefer rocks and rocky cliffs with their numerous niches. 3. Moisture-requiring ferns that choose deep, damp forests. 4. And the few who "sit always with their feet in the water" as we used to say of the Lady Fern.

Things to do

The children may check what they find with the above habitat list. After the children have become personally familiar with ferns and their habitats play a habitat game similar to the old-fashioned spell-down, not by spelling but by naming a fern that would be found in any habitat you mention.

If you have a shady, protected spot on your school grounds where ferns would thrive, it would be a delightful project to make your own fern garden. Remove the soil to the depth of ten or twelve inches and replace it with a rich loam, largely leaf mould, which the pupils bring from near-by woods. The ferns should thrive in such soil, and you can watch them develop day by day, new crosiers unfurl, sori appear and spores ripen, under your very eyes. A covering of different mosses over the leaf mould adds beauty and gives you something else to watch as they develop their spore capsules.

Driprints

You can make a permanent and very charming record of your finds by means of Driprints (formerly called Ozalids), much easier and quicker than blueprints and a positive instead of a negative print—a lovely shade of royal blue against a white background.

Inkprints

Inkprints of ferns, done with green printers' ink, are delightful and if the sori are not over-ripe or too undeveloped you can get perfect prints of those too, if the sori are on the regular fronds. Driprints would record the fertile fronds that do not lie flat.

Moss Capsules

Find ripe moss capsules that have not yet shed their spores and pick off the lid covering the lip. A hand lens will disclose a fringe of tiny teeth covering the opening. These stay tightly closed in damp weather. In dry weather some kinds open wide to release the spores; other kinds open by slits between the teeth so that every vagrant wind sways the slender stalks and sifts out the spores like pepper out of a pepper shaker. Shake some out yourself!

Fern Sori

Under the blankets of the fern sori are tiny stalked "paper" bags full of spores. (Hand lens again). The paper bag has a weak spot on one side, called the lips. When the spores are ripe the bag breaks at the lips with such an explosive snap that the spores are scattered hither and yon. The heat of your hand, when the spores are ripe, is enough to burst the bag and you can see it happen.

Horsetail Fun

Horsetails make charming Driprints. On a field trip they are fun to play with. They can be pulled apart at the joints and fitted neatly together again. Puzzle: find the leaves! No, the pine-needle-like side growths are not leaves, they are branches. The leaves are the tiny teeth, like a king's crown, that encircle the stem at the joints, noticeable only when you pull the joints apart. Use these joints as whistles. Blow across them and make the Pipes of Pan. You'll notice that the stems and branches are green, as is frequently the case in plants with greatly reduced leaves, so they can take over the food manufacturing job normally carried on in leaves.

The other common name for horsetails is scouring rushes, because our pioneer ancestors (as we campers do now) used them to scour the blackened bottoms of kettles. They're as good as sand soap or Dutch Cleanser for their tissues are full of silica, the chief ingredient of sand.

In the very early spring a horsetail plant sends up a stalk (usually without chlorophyll) whose sole business is to bear the spores. Look at the spores under a low-powered microscope. The spores seem to crawl all over. As soon as the spores are scattered the plant dies down and you seldom see it. Red-letter day when you do!

Shelf Fungi

When you find a shelf fungus on a log or tree, cut it off and on the unmarred underside draw a picture with a sharp-pointed instrument or pin. The scratched lines turn brown and the effect is very attractive.

Shelf Fungi always grow parallel to the ground so when you find some on a fallen log you can tell whether they grew on the tree before it fell or afterwards. Some shelf fungi have lovely, velvety upper sides in exquisite shades of green, brown, cream and tan. They make a nice collection.

Spores

Breaking up a ripe puff ball gives one a very vivid idea of the prodigality of spore production.

The air, everywhere, even very high above the earth, is unbelievably full of spores of the lower plants and the resting stage of minute one-celled animals. When I dried a lettuce leaf, crumbled it in a jar of water and stood the jar out of strong light but in a warmish place, in 48 hours the water was absolutely swarming with wee darting creatures too small to see except under my microscope—live Infusoria for my tropical fish babies. You can perform a more visible experiment by putting in a series of jelly glasses small amounts of food—crushed fruit, jam, canned fruit, damp bread, cheese, etc., and after exposing them to the air for 24 hours, cover them securely. Then watch! You'll not have many days to wait for colourful mould gardens to develop. No wonder Mother is so fussy about sterilizing her jars when she is going to do some canning. How many colours do you find in your mould garden?

Golden Age of Ferns

Ferns, club mosses, and horsetails had their Golden Age many millions of years ago. Then they were like tall trees. Even then they had developed true roots, stems, and leaves in which highly differentiated tissue systems provided amply for food making, food transportation, and food storage, and from them were descended flowering trees step by slow step.

Encroaching seas covered these forests of tree ferns and their allies and little by little changed their carbon into coal, the coal we use to-day, giving to that age the name Carboniferous.

Bracken

Of all ferns the Bracken has the most world-wide distribution. In many places this seems the commonest and most conspicuous fern because it fringes our roadsides and makes lovely patches in our pasture fields. I know of no other fern with so wide a range of habitat, from a dry sunny roadside to deep shady woods. It takes a good deal of hunting to find a frond small enough to print an entire frond on your Driprint Paper.

Hardy though it is in a spot of its own choosing, it's very difficult to transplant one successfully and that's where you learn from experience that what you thought was a perfectly adequate piece of root wasn't a root at all, but the underground stem. Remember? Fern stems are underground. Only the leaves show. The roots are something else again.

Because it is so available this is an excellent fern to watch in its unfolding stages and discover how each tiniest subdivision was curled in toward the next larger subdivision. Watch one unfold, stage by stage.

It offers an excellent opportunity to learn the meaning of a term very frequently encountered in leaf study, pinnate. This word comes from the Latin word "pinna" meaning feather, so pinnate means feather-like, with a midrib and leaflets branching off on either side. When the leaflets are again branched into smaller leaflets, the leaf is called twice pinnate. The lower branches of a Bracken frond are sometimes even thrice pinnate.

Bring in an armful for the children to examine and have a feather handy for comparison. Do different fronds vary greatly in their degree of pinnate subdivision? Let the children keep watch on their rambles to find the tallest and broadest bracken frond of all. No guessing! Take a tape measure with you.

Cut the stem of a bracken frond and what figure do you see? Considerable mediaeval superstition was connected with this figure which was often interpreted as "C" and supposed to stand for Christ; others thought it the devil's hoof, an oak tree, or one's sweetheart's initial. Aren't you glad we live in a day when nature's ways are seen as magic beauty and not all mixed up with black magic and superstition?

Flowering Plants --- Trees

If I wanted to kindle a lively interest in trees, I'd begin with the gayest adventures I could think up. If there were Sugar Maples handy I'd take the children to see the entire process of tapping the trees and making the syrup and sugar and end up, of course, by eating maple wax, made by dribbling hot, thick syrup over a big dishpan of clean, fresh snow.

Or, if there were native nut trees in nearby woods we'd go nutting and have a wonderful—not *too* educational—time.

When autumn leaves are at the height of their glory I'd take them on an adventure to revel in utter loveliness. We'd come back loaded with colourful treasures with which to make gay the schoolroom, and in our hearts the richness of those who walk with beauty.

I would *not* expect to kindle a very lively interest by starting with bare trees in winter, their leaf scars and lenticels, their winter buds or even their manner of branching and their silhouettes against the sky, though these are interesting enough to one who already knows and loves trees. Children like action.

Watch a Tree Wake Up

Start, therefore, when trees begin to wake up and catch them in the act. Bring in bare branches loaded with still sleeping buds, the bigger the buds the better, and watch the buds open and see what comes out of them. One never-forgotten spring I watched in my own garden a Broad-leaf Maple tree bud, less than an inch long, open. From it emerged 30 inches of new stem bearing 14 leaves averaging 8 inches in diameter. Can you top that record? You'll need to explain to the children that during the late summer, leaves for the next spring are being formed, cell by cell, every part perfect but in microscopic miniature and wrapped snugly in weatherproof bud scales to sleep the winter through unharmed. All the veins and leaflets and notched edges are there as you can see for yourself by cutting open a large bud, such as horse-chestnut, and examining it under a strong lens. When the bud opens at the warm touch of spring, every leaf cell expands and in no time at all you have a full-sized leaf.

A Year's Growth

Children enjoy examining branches, either in the open (best) or brought into the schoolroom, to compare the amount of growth made each year. When a bud, formed at a branch tip and called a terminal bud, begins to open, the protecting bud scales drop off leaving permanent scars surrounding the twig. A few inches or a few feet of new branch may develop from a terminal bud. Begin at the tip of the branch and look back till you find the encircling group of scars which mark the extent of the most recent year's growth. It is amusing to see how many years' growth you can trace back and compare them. Can you make any deductions about weather during a certain year from the extent of twig growth? Don't confuse the scars of opposite lateral buds, such as those of maples, with terminal bud scale scars.

Leaf and Flower Sequence

Note which trees put out leaves first, flowers later; and which do both at the same time. The elms always surprise me because they not only blossom but also ripen and drop their winged seeds before the first leaf appears. In sharp contrast to this, a Witch Hazel doesn't blossom till the leaves are not only out but *off* in the fall.

Stamen and Pistil Set-up

Discover some trees that have perfect flowers (with both stamens and pistils) as apple and pear trees do; other trees that put their stamens in one flower and their pistils in another but both on the same tree as do all oaks, alders, birches, and nearly all conifers and nut trees; and, third, those which place these staminate and pistillate flowers on separate trees as willows and poplars and some others.

Several years ago I had a thrilling adventure with willows. I had just finished telling a group of people, standing beside a staminate willow, that willows have only one kind of flower on each tree, when someone on the far side of the tree found a lot of pistillate flowers. She was right. There they were, both kinds on a single tree, which ran counter to the statement in all my text-books. When I reported this to my botany professor he said that in forty years of teaching botany he had only once encountered another misbehaving willow. It's great fun to find a "once in a blue moon" exception.

As soon as the pussies begin to appear bring into the school room branches taken from several different willows. Put these in water and soon some of them will be bristling with yellow knob-tipped hairs. They look rather like woolly caterpillars. These are stamen-bearing catkins. Others will be covered with greenish slender little milk-bottle shapes, the pistils. Can any of you find a misbehaving willow?

In most cases staminate flowers are bunched on conspicuous dangling catkins, very easy to find. The very inconspicuous little pistillate flowers are much harder to locate, but like all difficult things, rewarding when accomplished. Hunt for the very beginning of acorns and walnuts. They are usually nearer the tips of branches than the staminate catkins are. In this search you are likely to discover another of nature's canny devices. When a staminate catkin has shed its pollen, it is of no further use to the tree. So the tree thriftily discards it. You'll find them, all dry and brown, on the ground under the trees. When you once get into the habit of noticing nature's behaviour closely, there is never a dull moment.

Annual Rings

Find a clearing where stumps are left standing. Count annual tree rings and find out the age of the tree. Which years evidently had weather that encouraged vigorous growth? You might like to start a collection, as beautiful as it is interesting, of polished cross-sections of branches of various species of trees. Secure branches of uniform diameter, an inch and a quarter is ideal; let the wood dry out thoroughly, then saw it into sections of uniform thickness, about one quarter inch. The bark almost invariably falls off, so don't worry about that. Polish the little slabs to satiny smoothness with various grades of sandpaper. The result is beautiful to the eye and a delight to the finger tips and you would never believe there could be such contrasts in colour, width of annual rings, prominence of medullary rays, and shape of pith. The pith at the centre is the same shape in a major group; for instance, all oak pith is star shaped. What other shapes do you find?

LUMBERING AND CONSERVATION

If there is a lumber mill, lumberyard, or timber cutting available for visiting, it will be of keen interest to the children. Encourage discussions of uses that are made of wood and wood products, and find out all you can about modern scientific lumbering with an eye to future harvest of trees. In some lively manner you will want to stress the waste due to forest fires and the importance of fire prevention. What kinds of wood are used to make the furniture in your school and homes?

OTHER ACTIVITIES

Send a committee of children to find out from your City Parks Department the methods and time to prune and spray trees. If they can watch the men at work, all the better.

The older children will enjoy making a tree map of the school grounds or a near-by park done to scale, every tree numbered and the names and numbers put in the margin. Never forget that children find names in themselves dull unless interest has first been kindled in the species as a living thing.

Take a walk through the woods and let the childrens' sharp eyes search for injuries to trees due to insects, disease, fire, cattle grazing, man's carelessness. Any other causes?

Themes for other rambles in the woods could be animal homes or shelters; and what food is here for man or beast (beast to include insects and even a lowly slug).

ADVENTURING WITH LEAVES

To teach some technical but important information in an acceptable fashion, I have found a study of leaf types in the field invariably successful. Gather the group and ask them to find and bring back to you the following: (Blow a whistle to bring them all back when over half have returned)

1. A simple leaf with one blade on one stem. 2. A simple leaf with parallel veins each running all the way from stem to leaf tip. Tell them not to stir from where they are, to find this (a blade of grass). 3. A simple leaf with featherlike veining, called pinnate, because pinna is the Latin word for feather. Have a fair-sized feather in your pocket to show them (elm leaf). 4. A simple leaf palmately or radiately veined in which the *main* veins radiate from the end of the stem to the stem to the leaf margins as the bones in your hands diverge from your wrists (in maples). 5. A compound leaf made up of leaflets, each with a wee stemlet. a. Arranged in the pinnate pattern (rose leaf). b. Arranged palmately (clover leaf). I've never yet seen a child who didn't love to run and hunt and find things for himself. This is a short project easily carried out in any park or garden or on most school grounds. It definitely dampens the fun if you make them learn the names of all the leaves. Get the types clear at first and fix them by proper groupings on pages of ink prints.

A field trip to gather leaf material for an appreciation of variations in leaf margins is very rewarding and can be recorded by ink prints. The same is true of leaf textures, as even *they* show up well in prints. Leaves nibbled or skeletonized by insects or other predators make charming prints. Variations in shapes of leaves in a single species, as the Sassafras, furnish another good project. Do you ever find two leaves exactly alike?

Canadian Nature, Nov. '46 pp. 168-172, has a superb article by Arthur B. Williams, "A Tree and the Forest", which will give you, simply and clearly, all the scientific information about trees you could need. In passing it on to the children, link the fact to the living thing in the field so they can see it and touch it and, by experiencing it, make it a part of themselves.

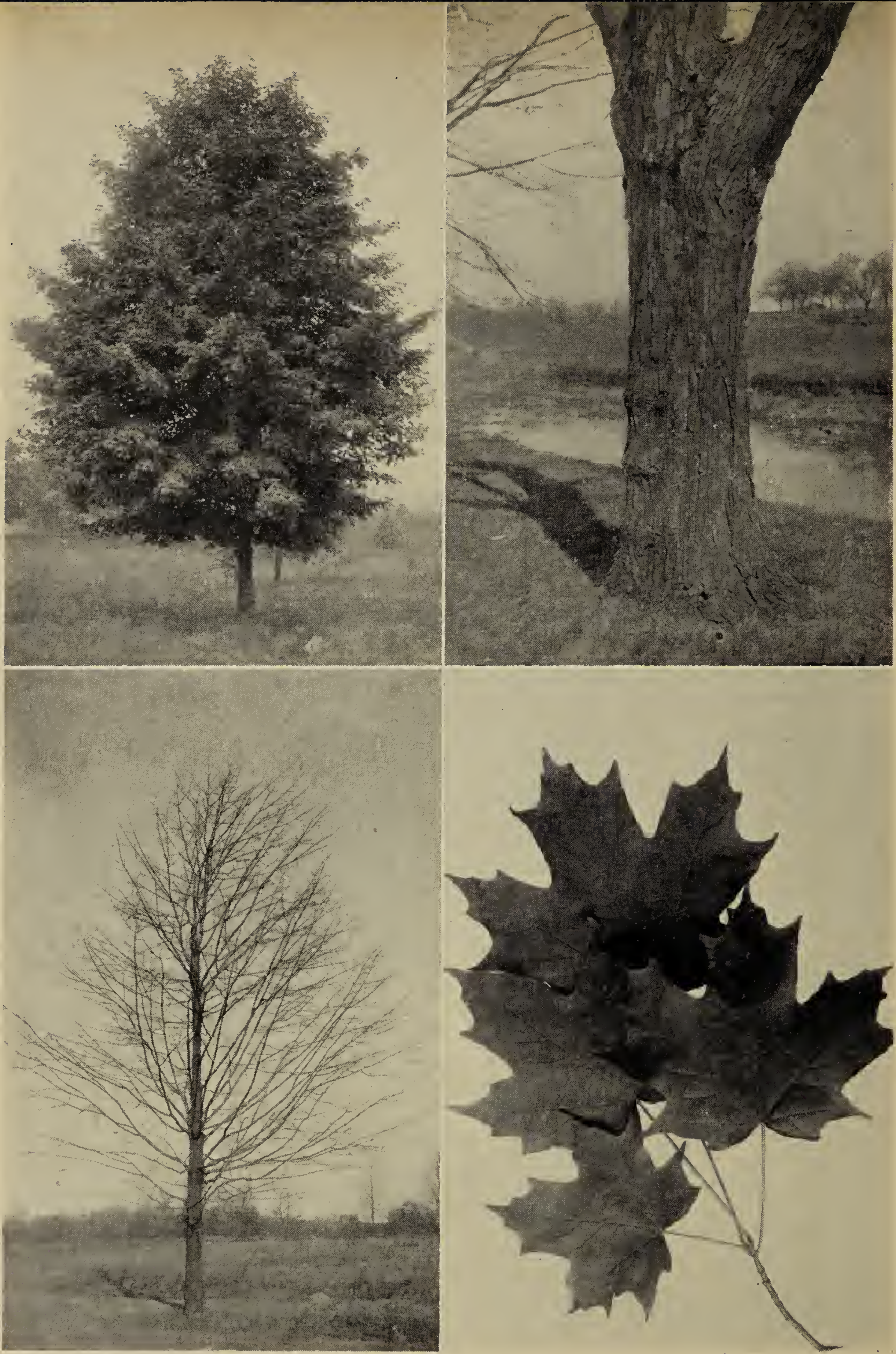
The Maple

MABEL PARSONS, in her "Story of Maple Sugar" in *Canadian Nature,* Jan. '46, p.22, tells how the Indians introduced maple sugar to the world.

Mrs. Anna Botsford Comstock, in her "Handbook of Nature Study", pp. 738-741, has given a charming and nostalgic account of the maple sugaring processes of her grandfather's time. It will be very interesting to compare methods of Indians, white pioneers, and modern science, with a maple-wax party to top it off.

Mrs. Comstock says maple leaves do not take on autumn colour evenly at first. Do you find this an invariable rule that applies to all maples?

On what date do the leaves begin to fall? Do those branches whose leaves first turned



a bright colour shed their leaves before the others? At what date does your tree stand bare?

Can you tell the maples apart by their leaves and seeds? Maple seeds usually come in pairs. The Broadleaf Maple of the Pacific Coast likes variety. One of my most interesting adventures has been the finding of Broadleaf Maple seeds in all combinations from 1-7.

See whether other maple seeds are invariably twinned.

Throw a handful of maple keys into the air on a windy day and measure how far the farthest is carried.

Do you find that on all species of maples the leaves are opposite each other? Examine the scars left on the bare twigs where leaves once were. The tiny dots in these leaf scars are called bundle scars and mark where veins carrying sap passed from the branch to the leaf. The shape and arrangement of these bundle scars is one method of identifying a species. You can get impressions of them in modelling clay and then in plaster of Paris. They make an interesting collection.

Notice the difference in shape of a Maple growing alone in a field and one in a dense forest. Let the children figure out the reasons.

THE ILLUSTRATIONS

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1. Sugar Maple in summer
2. Sugar Maple in winter
3. Sugar Maple — trunk
4. Sugar Maple — leaves

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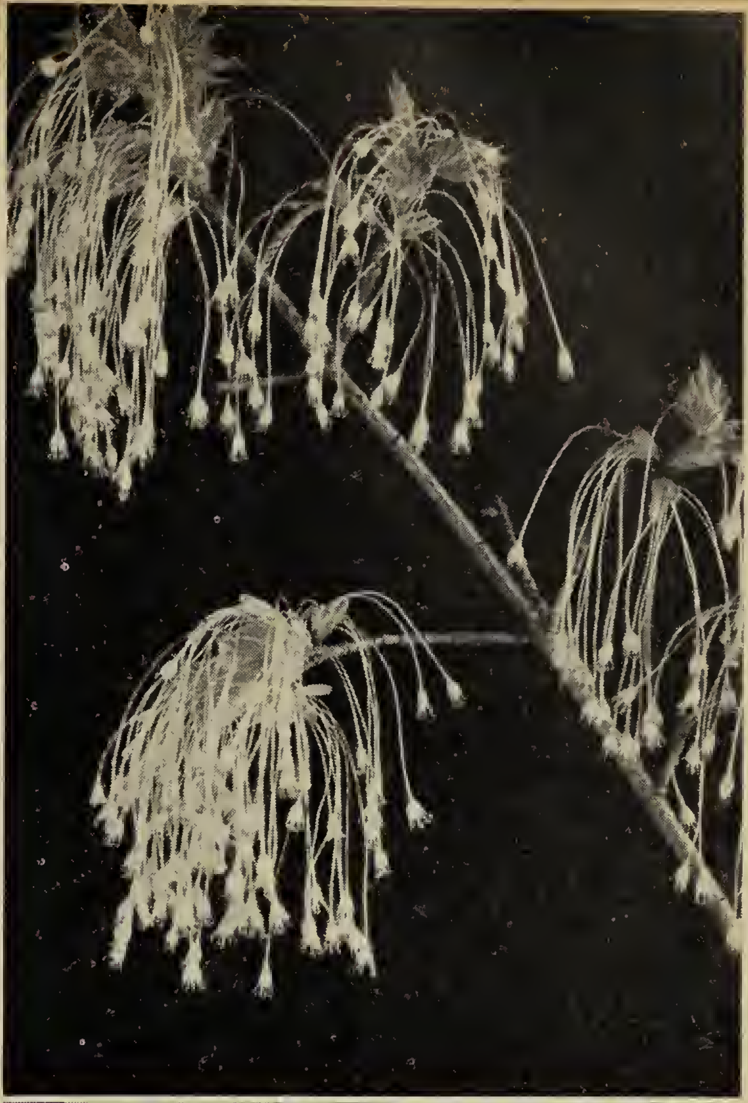
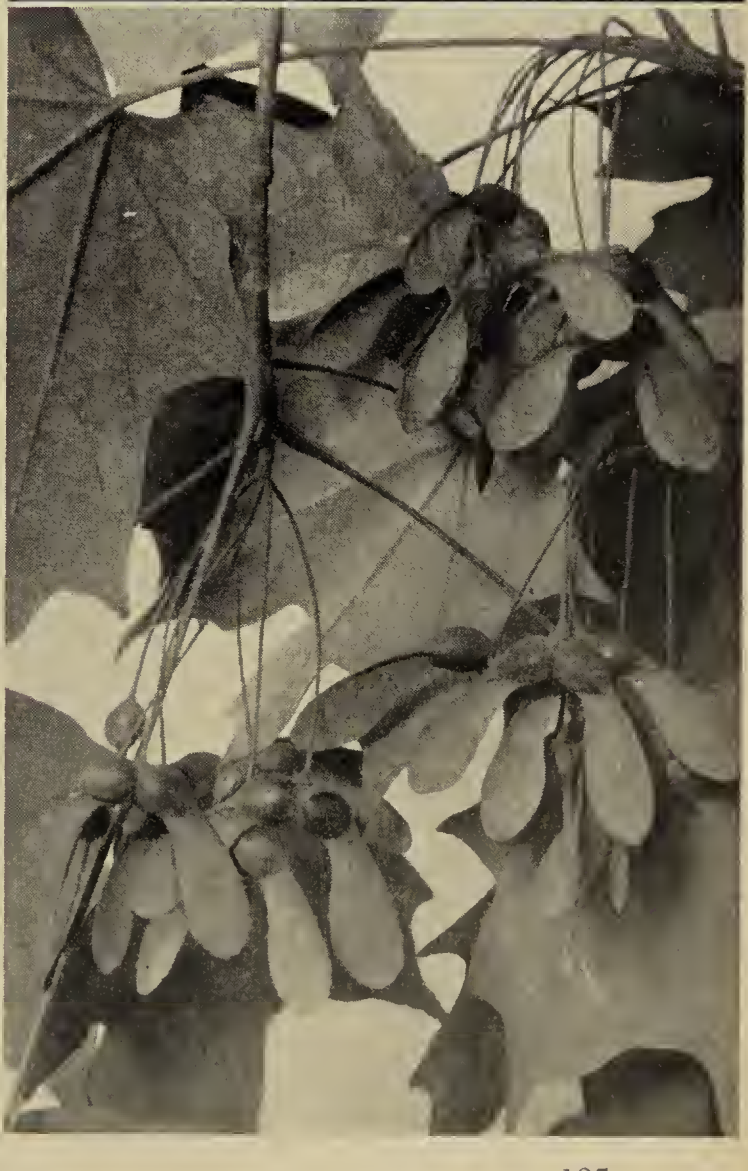
5. Sugar Maple — flowers
6. Sugar Maple — fruit





Flowering Plants --- Herbs and Grasses

Bring in a wide assortment of large simple garden or wild flowers and let the children pick them to pieces and locate for themselves the different parts till they are comfortably familiar with the uncomplicated ones. Go off on adventures hunting interesting variations in plant behaviours and contrivances, as for instance:

Calyx

Flowers that discard the calyx when the flower opens as in the entire poppy family—bloodroot, celandine, and cultivated garden poppies.

Cases where the calyx opens up flat to let the flower blossom and then closes up again to protect the seed box or ovary in which the seeds are forming as in herb Robert.

Flowers with coloured calyx and no petals as wild ginger and four o'clocks. What else can you find odd about calyx behaviour?

Corolla

How many colours of petals can you find? Which colours are commonest? Do flowers of the same kind have the same number of petals or are there variations? What colours are nightblooming flowers? Examine a red four o'clock and see if it makes up in fragrance for its hard-to-see-at-night colour.

It's fun to discover variations in time of day for flower opening and closing and the number of days that a flower retains its petals. In California a common (but interesting) weed, the Alfilaree, opens early in the morning and by noon every petal has fallen. Can you, in your vicinity, find a flower with a record that beats that? See what bloodroot does and wild geranium or cranesbill.

A bright coloured string, tied loosely around the stem of a flower you watch open, marks it so you can be sure which one you are observing. For many types of observation you can find on a single plant or on neighbouring plants of the same species, flowers in different stages of development and discover in one visit their behaviour at various stages.

Stamens

Examine for number of stamens, for length of filament, shape and size of anthers, colour of pollen grains.

Do try to find a large-flowered salvia in someone's garden. In it you can see the lever against which a nectar-hunting bee pushes as it enters the flower, and thereby gets itself spanked by the anther of the stamen. Its back is thus covered with pollen which will be brushed off against the stigma of the pistil of the next flower it enters. The complicated shapes of flower corollas are usually linked with insect visitors as pollen distributors.

Pistils

Compare flowers for shape and size of pistils, shape and colour of the sticky stigma on which the pollen is to fall, the length of neck or style; carefully watch the seed box swell as the seeds develop.

I used to think that a pistil was like an open-throated milk bottle and that the pollen grains just tumbled down this passage-way into the seed box below. But one very red-letter day I was lucky enough to see some movies taken through a microscope by a photographer-scientist showing what really happens. These more or less milk-bottle shaped pistils haven't open throats at all. The throats (styles) are solid plant tissue. Then how can the pollen grain reach the waiting ovule? Very simply but very wonderfully. Each tiny pollen grain pushes out a root-like finger called a tube with some chemical magic at its tip that dissolves the plant tissue in the style to make a passage way for the growing tube. In the tube, just behind the tip, is the important part of the pollen grain which will unite with the ovule as soon as it is reached and from their union a seed will develop. Each silky thread, that has to be so laboriously removed before corn can be cooked and eaten, is the style of a pistil down which a pollen tube had to make its way, or a kernel of corn would be missing on the cob. That so many ears are completely kerneled is all the more remarkable when you realize that corn depends on wind to scatter the pollen produced in the tassel at the top of the corn stalk. Each day adds new zest to living if you are interested in nature!

Growth and Motion

One of the most surprising things about

plants is the stubbornness with which growth goes in certain directions, roots down, stems up, leaves usually toward the light. An interesting experiment is to plant some seeds in a medium sized box 6″x6″x10″, not too small but easy to handle. Use large seeds, as lima beans, peas, nasturtiums, grains of corn. Keep warm and watered and when most of them are up about two inches turn the box on its side and you'll see the stem-tips, now parallel to the floor, will turn at right angles and grow upward again. Let them make definite growth in this direction and then turn the box again. How many times can you make them change direction before they get too tall or floppy to cooperate in the experiment?

To illustrate the tendency to turn toward light, plant some nasturtium seeds in a flower pot and place it in a sunny window, turning the pot half way round as soon as the leaves are very definitely turned toward the light. How rapidly do the leaves turn back toward the light?

These are not the only plant movements fascinating to watch. Hunt for others yourself. What flowers hang their heads in bud and stand erect in full bloom, as many poppies do? Find some that reverse this pattern as do Shooting Stars on the Pacific coast. These even come erect again in the developing seed capsule. What shift in position do you discover in Indian Pipes? Mark off equal divisions in indian ink, from the tip up, on the root of a sprouting pea. Within twenty-four hours you will be able to tell which part of the root is growing fastest because the marks are no longer evenly spaced.

Clover leaves and Sorrel (Oxalis) leaves, so similar in shape and appearance, have opposite night time behaviour; both fold their leaflets in the middle but the Sorrel leaflets hang down, the Clover leaflets stand up in the air at night. Since Clover and Sorrel are both often found in your lawn, that is a handy place to compare them. The larger Redwood Sorrel in California does a funny thing. When the sun hits it, the leaflets repeat their night time behaviour. As soon as they are in the shade again, the leaflets come up to the normal flatly horizontal position. If you have a woodland Sorrel see whether it behaves like the western species.

Pick a handful of the larger yellow evening primroses and put them in a vase on your supper table, for just about that time the buds will open wide before your eyes and fast enough to be very exciting.

Watching blue-eyed grass go to sleep at night is fun because instead of folding its petals up as most night-closers do, it tucks them in, rather like a small boy struggling to get his shirt tails tucked neatly into his trousers.

Many kinds of Mimulus have two-lobed stigmas which, at a touch, close quickly together. Children in the West never tire of touching stigmas of the Sticky Monkey Flower with a grass stem and watching them close. The Musk Plant does the same thing but the stigma is smaller. You might experiment with that as we did with the Monkey Flower. We found that it opens again after 30-45 minutes (fastest when the sun is on it) and can then be closed again with a touch. One we experimented with opened half a dozen times a day. We also found that none of our stigmas opened after we touched them with pollen taken from stamens of the same species. Do you find this true of the Musk Plant? Don't fail to mark your experiments with coloured strings.

While many flowering plants devise elaborate arrangements for securing cross-pollination, some seem quite indifferent to it and one even discovers flowers that never open and so prevent cross-pollination and yet produce sturdy seeds, as the Closed Gentian, and the tight-closed inconspicuous lower flowers of Jewel Weed or Touch-me-not, and close-to-the-ground buds of some violets.

Some Things Are Not What They Seem

Dogwood and Bunchberry are examples. Nearly anyone would take for granted that the greenish yellow centres of both are stamens and pistils, and the showy white structures are petals. Nay, not so! The showy white structures are modified leaves masquerading as petals and the inconspicuous centres are many tiny tubular flowers bunched together. Incidentally, if you touch these wee buds gently when just ready to open, they pop open startlingly under your finger. Modified leaves masquerading as petals are found in the florist's Christmas Poinsettias and the gorgeous Bougainvilleas that cover so many western or southern homes with flaming masses of colour.

The Trap Setters

Among the most exciting plants are the

trap setters such as the Sundew, Pitcher Plant and Milkweed. Sundew catches insects on its sticky tentacle-covered leaves, closing its tentacles down over the insect and digesting it, if you please!

Pitcher Plants trap insects in the hollow leaf bases with down-pointing hairs so they fall into water at the bottom and drown, making a nice rich broth for the plant.

Milkweed has little slits near the centre of each flower in which an insect catches a foot. The tug of pulling the foot free dislodges curious little yoke-shaped masses of pollen which are carried on the claw to the next flower unless the insect fails to pull loose. Look in Milkweed flowers for insects that didn't pull free.

Seed Dispersal

The ingenuity plants show in assuring their seeds' dispersal is every bit as interesting as their devices for attracting insects and insuring cross-pollination. A seed dispersal adventure afield is great fun. What the children discover for themselves is worth so very much more than dry book facts. Hunt for plants that shoot their seeds; plants with seeds specially adapted to be wind-borne, or water-borne, or to hitch-hike on or in animals.

Usefulness to Man

A fruitful project is the usefulness of flowering plants to man. It will make a long and varied list. You will also want to know which in your vicinity are harmful or poisonous. Find out the part of a plant used in each case for food, whether root, tuber, stem, leaf, bud, flower, fruit or seed.

Plant Associations

An exciting project is to know your plants by the company they keep—plant associations they are technically called—plants you find together in a certain habitat because they are all adjusted to the same amount of moisture, sunlight or shade.

Plant Families

By degrees, as flowers become your intimate friends, you will be able to recognize at a glance some of the simpler family characteristics. The lily, pea, violet, mint and composite families are easy and cover a great number of species.

Prints

Driprints of plants and inkprints of leaves will make a treasured record of your more memorable discoveries.

Conservation

You will all want to be first class conservationists going even beyond the letter of the law to protect beauty for future generations.

Insects and Their Next of Kin

I put in the "next of kin" because it seems to me just as important to know what isn't an insect as to know what is. Many people think a spider is an insect, and very, very few are aware that a tick is not.

The Jointed-Leggers

The jointed-leggers (Arthropods) all wear their skeletons on the outside as a skin toughened with a substance called chitin. They have been divided into five big groups which can be easily told apart, even by an amateur, by counting the number of legs. Here they are:

1. True adult insects, such as crickets, beetles, butterflies and bees, have three pairs of legs.

2. The spider group, which includes daddy-long-legs, mites, ticks, scorpions, and spiders, have four pairs of legs.

3. Crustaceans, lobsters, crayfish, crabs, shrimps, and pill bugs or sow bugs, have five to seven pairs of legs.

4. Hundred-leggers, as centipedes, have one pair of legs on each body segment, but in only a few species are there enough segments to produce really 100 legs or more. Count some and see what number you get.

5. Thousand-leggers, as millipedes, have two pairs of legs on each segment, too small and too close together to count easily. But these last two groups are easy to tell apart because centipedes are rather flattened, very active predacious creatures, and millipedes are round in cross-section, very slow-moving, and strictly vegetarian. They curl up when captured. See how easy it is to tell these groups apart? An adventure afield to find examples of them is lively fun. Sorting them

into their proper pigeon-holes will help you to remember their differences. Read "Animals Without Backbones" by Ralph Bucksbaum. It's simply written and packed with information and pictures.

Since every Arthropod has a tough, inelastic, outside skeleton, but keeps growing inside it, there is no alternative but to burst the tough skin and crawl out with a new, larger skin. The new skin formed beneath the old is elastic and soft at first but quickly hardens on contact with the air.

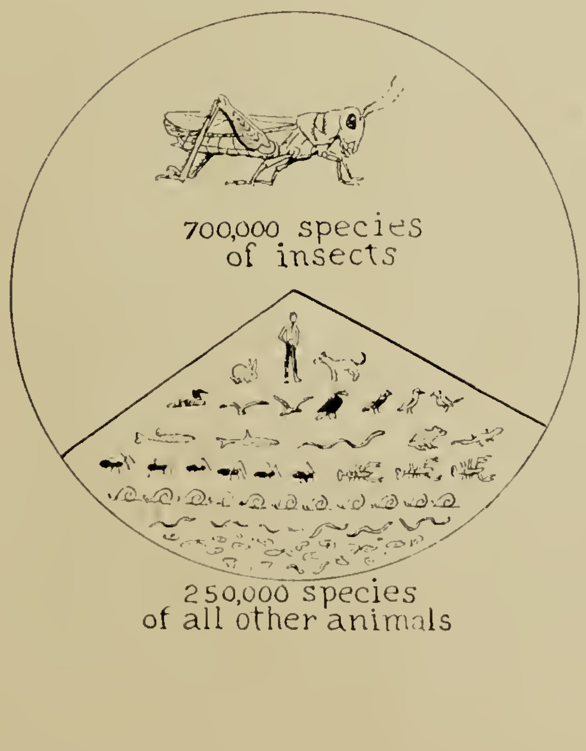
It's highly entertaining to watch an Arthropod crawl out of its skeleton, which it must do periodically, till it is a full grown adult. This is called moulting.

Insects

There are more kinds of insects and more insect individuals in the world than all other animals put together. There are likely to be more insects in your garden than there are people in your city. Unless you've tried unsuccessfully to get rid of them, you would be surprised how many find a home on your dog or cat.

Insects are also the most widely distributed of any group of animals for they are found in the air, on land, underground, on and in water, on and in plants and animals, on deserts and in marshes, in tropical jungles and in Arctic regions.

Fossil insects closely resembling the more primitive insects of the present day have been found in beds of coal dating back several million years and their first, most primitive ancestors must date untold millions of years farther back than that.



If success be measured by number of species, and, of individuals by wideness of distribution, and by length of time of persistence, then surely the success of insects is without rival.

Reason For Insect Success

Think about and discuss with your pupils the reasons for this success. Here are a few suggestions:

1. The tough outside skeleton protects against injury and drying out.
2. Their small size makes hiding easy. Many kinds develop from egg to maturity in a very short time permitting several generations in one season. Use is thus made of seasonable food supplies or favourable conditions.
3. They have exhibited an extraordinary capacity for adaptation through the ages to every conceivable habitat and condition of living, not least of which is the ability to "sleep" through adverse conditions, sometimes in the egg or pupa stage, less often as an adult or a larva.

Metamorphosis—Nature's Cinderellas

I do believe every child has an inalienable right to watch tadpoles change into frogs, and homely caterpillars pupate and emerge as beautiful butterflies or moths. As a child I used to keep my caterpillars in cardboard boxes with ventilating holes punched in the lids. Later, I evolved much better cages, easier to see into, and simpler to clean. I now use glass fruit jars with wire fly screen cut to fit the screwed-on rings. Each day I dump out on a newspaper the caterpillars, partly eaten leaves, and rubbish, and put the caterpillars and fresh leaves in a clean jar. The old jar I rinse clean in hot water and stand in sunshine. The newspaper of rubbish goes into the incinerator.

Raise as many caterpillars (separate glass jar to a species) as you can and watch them spin cocoons or turn into chrysalids. What happens to the caterpillar skin?

Collect as many cocoons as you can find and keep in a cool, not too dry place during the winter so you can watch what emerges in the spring.

The changes that have taken place in the pupa stage are one of nature's major miracles.

You can see many of them by comparing caterpillars and butterflies but the internal changes are equally amazing, not least of which is the alteration of the digestive system from a long elaborate one adjusted to digesting chewed vegetation to a very short one suited to digesting highly concentrated nectar.

On a ramble with younger children collect caterpillars and watch their behaviour as they crawl, climb, look about, hold on, and eat. It's fun to start tent-caterpillars or "woolly bears" on a line and have a race. Or put two caterpillars on a twig facing each other and see what happens when they meet.

If you find a dead butterfly or moth, rub a wing gently between your fingers and examine under a strong lens the scales that came off on your fingers. Also examine the undisturbed scales and see how they overlap on the wing, like shingles. Is the colour wholly confined to the scales? What does the wing look like with the scales removed?

This same butterfly or moth, if not too long dead and brittle, furnishes an opportunity to examine the long coiled sucking tube. You can uncoil it with a pin. How long is it? Also examine under the lens the compound eyes.

Watch live butterflies and moths in flight and note how they differ in manner of flight.

It would be a real public service to collect and destroy the egg clusters of tent caterpillars.

Let the pupils search through a garden and collect samples of injurious insects and the harm they have done to plants. Then let them tell the class about their discoveries and show the material they have collected. This leads easily into the problem of insect control. Help on this is available from your Department of Entomology, the Departments of Agriculture of the different Provinces or States.

THINGS TO OBSERVE IN YOUR INSECT ZOO

Insect zoos housed in terraria or lamp-chimney-flowerpot-cages will lead to numerous absorbing discoveries.

There the children can see for themselves that typical adult insects have, beside their outside skeletons and six legs, three body sections (head, thorax, and abdomen), two antennae, two or four wings, and usually compound eyes. A few very primitive forms and many parasites are wingless.

How many wings have flies and mosquitoes? Count before you swat! Only female mosquitoes sting and "sing". Their antennae are thread-like. Male mosquitoes have large feathery antennae and feed only on plant juices. To watch mosquitoes develop from egg to adult in a well-screened jar of water is interesting.

MOUTHS

Notice mouth parts and "table manners". Which insects chew their food, which lap it up, which have a piercing beak through which they suck liquids, and which have a long, coiled sucking tube?

EYES

It's easy enough to locate the large compound eyes made up sometimes of thousands of units. A dragonfly's head seems to be nearly all eye. Sharpness of vision is roughly proportional to the number of units. Can you find the small, simple eyes many insects possess on the "forehead" between the compound eyes?

ANTENNAE

Observe the variations in size and shape of the feelers (antennae), and how they are used. Many of them are very sensitive to odours and sounds.

SOUND MAKERS

Sound making devices are, in insects, never vocal organs in the throat, but mechanical, wing against wing, in the file and scraper of crickets and katydids, leather wing against delicate wing of some grasshoppers, striking wings together as among locusts and cicadas, or rubbing legs against body or wings as a western cricket and beetle. Also there are the sounds, humming and buzzing, due to rapid wing beats, purely incidental to flight.

EARS

Insect ears aren't located where you'd expect them either. It is believed that many insects pick up sound waves in their antennae. Look for "ears", small, flat, oval spots on the front legs of crickets and katy-dids and for one on the abdomen of a grasshopper. Queer places to wear one's ears!

INSECT COLLECTIONS

Insect collecting and mounted collections appeal to almost every young person. It is a hobby well worth encouraging. You will find enticement and practical help and suggestions elsewhere in this book.

INSECT CIRCUS

It's great fun to work up an insect circus

with all the typical ballyhoo of extolling the interesting features and behaviours of each child's caged pet.

EXHIBITS

A highly interesting exhibit would be a display of work of insects, nests, cocoons, galls, honeycomb, and tunnels in wood.

Other displays could be worked up on damage done by insects or on benefits from insects.

VALUE OF INSECTS

Have a lively discussion on the value of insects to man. You might launch it by listing what would happen if every insect on earth suddenly died.

The Field Cricket

THIS is an insect easy to secure and keep in a lamp-chimney cage. Also it's interesting to observe. Be sure to get both males and females, the latter recognized by their tail-like ovipositors.

When you try to catch your crickets, do they run or jump or fly in trying to escape? Notice the difference between the wings in both males and females and under a strong hand lens look for the file and scraper that form the male cricket's violin. Can you see the wings vibrate when the male serenades his lady love?

Watch your crickets use their antennae. Do you ever see them clean them? How?

Notice the spines on the legs that give a cricket a good perch on the ground for a strong leap. Give them a bit of melon or apple to eat and watch the motion of their jaws when they chew. Is it up and down, like yours, or sidewise? Do they ever use the front feet as hands? And of course you'll hunt for their ears on their elbows—what a place for an ear! What else of interest can you discover by watching your crickets? Try keeping crickets alive all winter in a sod-bottomed cage.

Fish

SOMETHING new under the sun! With fish a backbone arrives on the scene and an internal skeleton, not suddenly, of course, but by infinitely slow steps, for that is the way of evolution.

Fish, alone of all the animals with inside skeletons live their entire lives in water, the original home of primitive plants and animals.

COLD-BLOODEDNESS

Ask almost any child what a "cold-blooded animal" is and he'll very logically come back with the answer, "an animal with cold blood". This is a good place to get that matter cleared up, for we'll be adventuring with fish, frogs, turtles and such for some time and they are all "cold-blooded". Birds and mammals alone can keep their body heat at an even temperature regardless of the temperature of the air. The other three groups have the same body temperature as the water or air in which they live, not bad for fishes because water maintains a fairly even temperature itself, but put toads or snakes or lizards in very hot sun and their temperature rises so fast it kills them in a matter of minutes if they can't hop or wriggle or run off to a spot of protective shade. A cold-blooded animal dies quickly from being too hot while a warm-blooded animal keeps comparatively cool even in a hot environment.

ADVENTURING WITH FISH

Your adventure with fish will rouse much livelier enthusiasm if it has two foci: 1—Fishing trips 2—Aquarium which the children help you set up in the schoolroom and stock preferably with local material the class collects in near-by ponds and streams.

FIRST, A FISHING TRIP

That's fun in itself because the fish caught can be handled and are large enough to be examined in detail. Enthusiasm will mount as you prepare for the trips by discussing the best spots for fishing, the best time of day, the best bait, adequate fishing tackle. Then the day arrives and you are off for happy hours in the open!

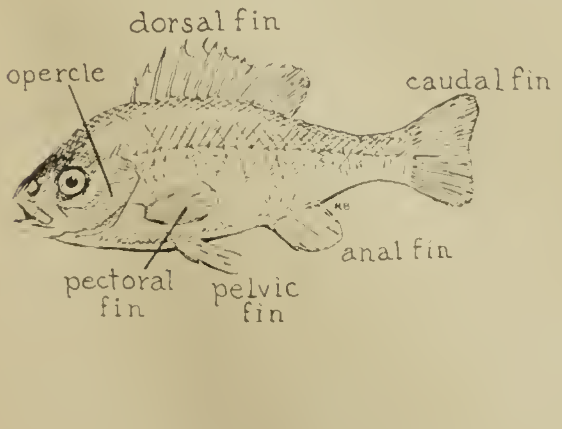
THINGS TO OBSERVE

What kinds do you catch? Which are the gamest fighters? Which the most sluggish? Do any of them have devices for offense or

defense? Do you find any scars of old injuries? How wide a range of colour and markings do you find? Is there much difference in shape and position of mouth and teeth? Find any eyelids? Why wouldn't fish need them as air-dwelling mammals do? You'll find it interesting to compare the size and shape of scales on different species. Do they always overlap like shingles? Which fish have no scales?

Lift the gill coverings and count the number of gill arches in each cheek. Do you find the same number in all species? The colour is due to blood in vast numbers of thin-walled blood vessels in the gills. Oxygen in the water can easily pass through into the blood stream while carbon dioxide passes out of the blood into the water through these thin walls. This is how a fish breathes.

The variations in number, size, shape and position of fins are especially interesting. Put an outline drawing of a typical fish on the blackboard to help the class with the names of fins.



It will surprise many of the children to learn that the pectoral and ventral fins correspond respectively to the wings and legs of birds and to their own arms and legs. The use of the fins varies with different species, but in general the dorsal and anal fins increase the vertical surface of the fish and help in maintaining an upright position. The tail fin and flexible rear end of the body are the chief means of locomotion. The pectoral and ventral fins are used mainly as balancers. The constant riffling motion you see in the pectoral fins, even when the fish is stationary, is to keep the head which is the heaviest part of the body from sinking and the body from turning belly side up, for the back is heavier than the belly. Encourage the children to lie quietly on a stream bank or a bridge where they can watch fish in the water below and discover for themselves different uses for fins. Try to have in the aquarium a fish large enough for accurate observation. Which fins are used in swimming backward or in darting to left or right?

By All Means, an Aquarium!

Even more exciting than fishing trips will be the excursions to obtain live material for your aquarium, both fish and water plants. You will find full instructions for establishing an aquarium elsewhere in this book.

Fish require oxygen and give off carbon dioxide; plants need carbon dioxide and give off oxygen. This is why you can and should have what is called a "balanced" aquarium, plants putting into the water the oxygen the fish must have, and fish contributing the carbon dioxide the plants require. Not much danger from too many plants but definite trouble, if you have too many fish.

Breeding Habits

The most interesting thing to watch in an aquarium is the variety of breeding habits. Do your best to have some breeding pairs, sticklebacks that are egg layers and amazing nest builders, hardy little guppies which give birth to living young. If your school can afford a heating unit and thermostat it opens up a fascinating and colourful field of tropical fish. Do have among them a pair of bubble-nest builders. My Dwarf Gouramis built three bubble nests in three weeks and spawned from fifty to two hundred eggs each time, quite out-classing the proverbial guinea pigs! The parents have to be removed after spawning for they gobble up their offspring as soon as hatched, the cannibals!

However, newly hatched young are tempting tid-bits to any aquarium fish so if you want to raise the youngsters, give them an aquarium to themselves.

Disposition and Behaviour

Disposition and behaviour furnish an endless source of entertainment. Some fish are like the male stickleback, pugnacious little bullies. Some are extremely active, others definitely sluggish, some seem always hungry, others wait to eat till the rest have finished. Drop into the aquarium small bits of cut-up earthworms too large for a single mouthful and watch the fishes snatch the morsels away from each other, looking ludicrously like football players running with the ball. Or feed them tiny whole white (*enchytræ*) worms. Watch them swallow, in from one to several gulps, a worm almost as long as themselves. If the white worm is too long and an end protrudes from a fish's mouth, a lively game of tag follows that is

THESE YOUNGSTERS know the joy of getting close to nature.

great fun to watch, also good exercise and excellent food for your fish! White worms are easy to raise in a box of moist earth if you can get an aquarist to give you a few as a starter. They thrive on dry rolled oats and cornmeal and multiply very, very fast.

AN INTERESTING COMPARISON

If you have in the school a goldfish and a canary, it could be fun to list their similarities and differences.

FISH HATCHERY

If there is a fish hatchery in your neighbourhood, do take the class to visit it, especially at the time the adults are being stripped of eggs and milt in order to insure controlled higher-percentage fertilization. A man in charge will explain the process and tell how lakes and streams are being restocked.

CONSERVATION

Take advantage of this opportunity to advocate conservation of natural resources, the importance of knowing and conforming to fishing laws so that the supply of fish, both for food and for recreation in fishing, will never be exhausted. A committee appointed to interview the local game warden or a member of the Department of Game and Fisheries might come back full of good ideas, knowledge of the fishing laws, and what small fish you can legally capture for your aquarium. This could be very interesting and worth while. For instance, find out the time for a fish to reach maturity.

Amphibians

HERE we mount another rung of the ladder in the long evolutionary climb upward. The arrival of frogs, toads and their relatives on the scene marks a very exciting step in progress for no longer are animals to be locked fast in a watery world. Their bodies have developed so that they are fitted for breathing air and, in consequence, living on land, although most of them still live in water for part of their life. They are called *amphibians*. The first part of this name comes from the Greek word which means "both", the second from the Greek word for life. So *amphibian* really means *"both"* or *"double-life"*.

The two groups of amphibians common in the temperate zone are: (1) salamanders, and (2) frogs and toads. The former retain tails throughout life and hatch out of the egg with legs. The latter have no tail in the adult form and do not have legs when they emerge from the egg as tadpoles. The legs develop as the tadpole grows older. A few salamanders lay their eggs in moist places on land and the babies go through the larval stage in the egg and never live in water—a very strange behaviour-variation indeed. A few others, like mud-puppies and hellbenders, never leave the water.

AQUA-TERRARIUMS

Your adventures with amphibians should centre in a vivarium where you can watch their behaviour. Collect as many kinds as possible. Frogs you will find oftenest in or near water or in moist meadows; toads like a cool moist spot in your garden; some salamanders live entirely or mostly in the water while others you can find under stones and boards and rotten logs.

EGGS

Nearly all amphibian eggs are coated with a jelly-like substance that absorbs water and swells, protecting the eggs from drying out. The frog eggs are a compact mass, the toad eggs are in long strings. Try to secure amphibian eggs for your school aquarium and watch them hatch. A common fruit jar or even a jelly glass with water and a bit of lettuce leaf makes an adequate swimming pool for tadpoles if only a few are kept in each container. Protect them from hot sun.

TRANSFORMATION

Soon occurs one of the strangest miracles in all nature. The tadpole is transformed; lungs replace gills, a long coiled complicated digestive system, necessary for a vegetarian diet, is replaced by the shorter simpler one of a meat eater, and the bony girdles that supported the fins of its fishy ancestors now develop first hind legs, then front legs, that are pushed out through the skin. The tail isn't lost, it is absorbed into the body to help furnish material for all these new structures that are being developed to make possible a

life on dry land and a different type of food. Such really breath-taking processes do go on in this living world! What a pity to be blind to them!

HIBERNATION

Try to find a frog or toad which has recently emerged from its winter sleep and see how emaciated it looks. The whole subject of hibernating is fascinating. The tempo of functions slows down almost to the standstill of death. The fat stored in the body serves for food. The heart scarcely beats. Oxygen requirements are at a minimum. A frog can get the little oxygen it needs when hibernating in the mud beneath an ice-covered pond. It goes through its thin skin which, when kept moist, permits oxygen to penetrate.

THE SPRING CHORUS

When frogs and toads wake from their winter sleep it means that Spring is just around the corner. Can you recognize the "songs" of the different kinds? Listen and watch carefully and you may discover the choristers. It is worth the effort.

When their mating chorus is at its height, a visit to a pond will almost surely give you a chance to see them laying the eggs, the male firmly clasping the female around what would be her waist if she had one, ready to fertilize the eggs as fast as they are expelled.

PROTECTION

Frogs and toads haven't gone very far in the development of contrivances for offence or defense. Protective colouration and very nimble hind legs serve only fairly well. They are a staple item in the diet of many fish, snakes and birds. The toad, with its less nimble leap, is protected by exuding from glands in the skin so unpleasant and irritating a fluid that one taste of it teaches most of its enemies not to want another. Frog jumping contests are fun!

STRUCTURES

The thin skin, never scaly, is moist and slippery and smooth in the case of frogs and salamanders, dry and warty in toads. See for yourself!

Do any amphibians have claws? Do all have the same number of toes on front and hind feet? What is the extent of the webbing? Watch many kinds of amphibians swim and see whether the front legs are used at all or only under certain circumstances. What is strange about the inner finger of male toads and frogs during the mating season?

Study their eyes, often beautiful in colour, with movable upper lid and a blinking membrane which can be drawn across the eyeball from below. What is the shape of the pupil? Colour of iris?

Can you locate the ears back of the eyes, smooth elliptical membranes by means of which vibrations produced by sound waves are transmitted to the inner ear?

DO KEEP A TOAD

Be sure to have a toad in your terrarium so you can try to catch a glimpse of its most peculiar tongue. It is attached at the front of

the mouth instead of the back and is sticky and forked at the tip and can be flipped out to capture an unwary insect and then flipped back to place the insect at the back of the throat, handy for swallowing. The best way to see this is to put a buzzing fly or a wriggling worm in a small clear glass bottle and hold it in front of the toad. It will thrust out that tongue to impale the wriggling morsel; your eye will have to be quick to see it. How many times will your toad strike at the bottle before he discovers the hoax and gives up in disgust?

Amphibians moult their skin, not neatly, all in one piece, as snakes and lizards do, but in shreds and untidy patches, and then —of all things—they gobble it up, so you have to be johnny-on-the-spot to catch your toad in the act. Try to do so!

Toads usually take only living food that moves. They will starve in the midst of plenty unless the food moves. If it's an emergency and the live food supply fails, try dangling small bits of hamburger pressed lightly to the tip of a dark coloured thread in front of them, and watch them gobble! What does your toad prefer?

Watch what happens to their eyeballs when toads swallow. Amusing that they use them to assist in swallowing!

When a toad gets hold of an inconveniently large morsel, it will stuff it into its mouth with both hands in a ludicrous manner. Mrs. Comstock says her pet toad would circle an earthworm till it could gobble it by the head-end, for it slides down more smoothly that way. See if your toads are as smart as hers. She also says the toad never drinks by taking in water through the mouth; it soaks it in through the skin. Fun to check on this, too!

Be kind to your toads; they rid your garden of many of the worst garden pests. In France gardeners even buy toads to keep in their gardens. It is estimated that one is worth as much as $20.00 to a garden in one season.

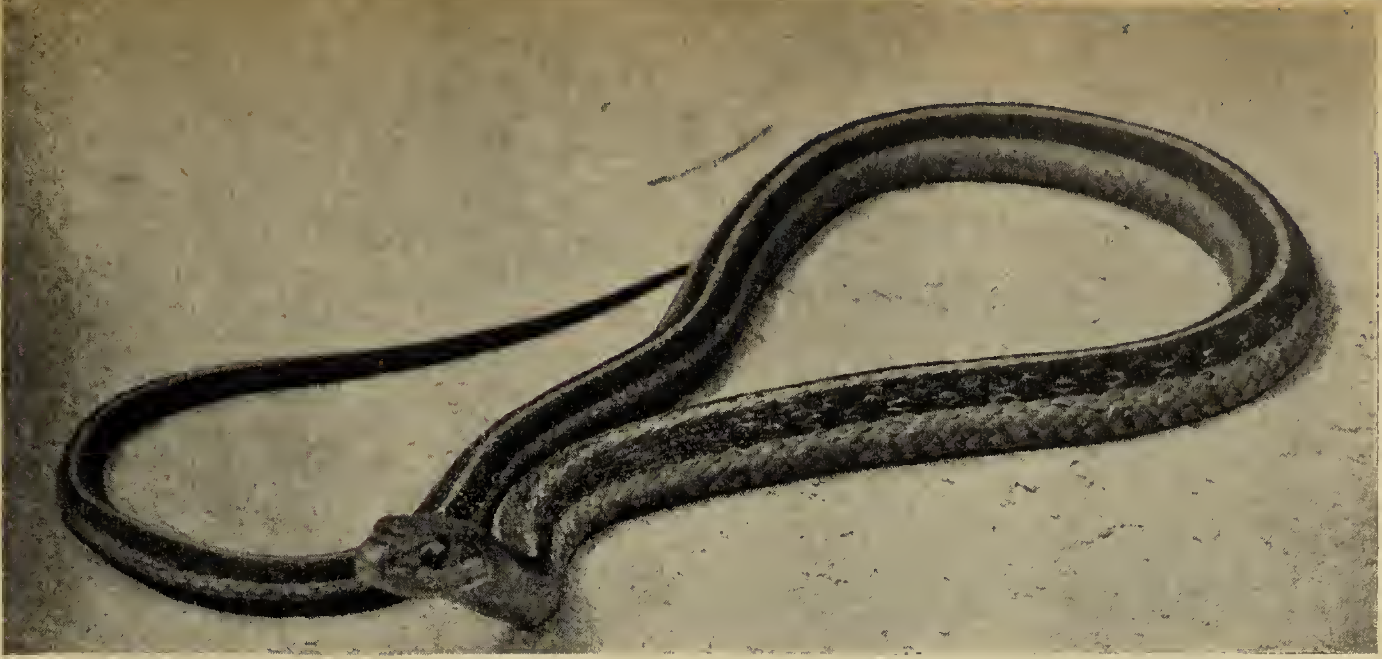
Reptiles

What's new in reptiles?

With fish, the front-page news was the development of a backbone and internal skeleton; with amphibians, the partial escape from a life in water—gilled young, but air-breathing adults. Reptiles are rid of gills at all stages of their life and are truly air-breathers even though many of them spend much of their time in the water. Like amphibians, a reptile's body temperature is the same temperature as its surroundings. Unlike amphibians, all reptiles lay their eggs or give birth to young on land.

Reptile Groups

Many people think only of snakes when they hear the word reptile, but snakes represent only one of four groups of reptiles: 1. Turtles and tortoises, 2. Crocodiles and



alligators, 3. Lizards, 4. Snakes. All have a more or less scaly moisture-conserving skin.

Ask almost any group of people the difference between snakes and lizards and you get an instant response of "Lizards have legs, snakes do not", and they stop there. By and large, that's not too impractical a distinction, but it isn't scientifically correct for there are several completely legless lizards; and a few snakes in the boa and python group, have tiny vestiges of hind legs but not usable ones. Here are three honest-to-goodness differences:

1. Snakes have no eyelids, lizards have.
2. Snakes have no external ear-opening, lizards do.
3. Snakes, beside having an elastic skin, have so loose-jointed a jaw they can practically take their faces apart and swallow a victim larger in diameter than their own bodies! Lizards have a conventional jaw and "suit the morsel to the mouth instead of the mouth to the morsel" as C. E. Benson puts it.

A snake can extend its jaw, a lizard can't.

A snake has no eyelids, a lizard has.

A snake has no ear opening, a lizard has

To return to the eyes, snakes have a thin transparent skin over their eyes and it is shed as part of the skin when the snake moults. Hunt for cast skins of snakes and lizards. They are shed from one to several times a year. You can see the eye-covering in the snake's and the holes in the skins where the lizard's eyes were. Can you discover how they get out of their skins? By splitting up the back, as insects do, or by walking out of their own mouths?

Set your class to work making vivaria and collecting live snakes, lizards and turtles. Keep some of them in the school room and encourage keeping others at home to make pets of and report on discoveries while watching them. The more kinds under observation the better, because this offers opportunities to note differences, not only in structures and markings, but in behaviour and disposition. Many reptiles are easily tamed and make highly interesting pets. Be sure to have either a Garter snake or a Water snake for they both give birth to living young. What wild excitement some morning when the children discover 20 or 30 snakes in place of 1 or 2!

A cage is easily made for snakes or lizards from a packing box 2′ x 3′ x 1½′ high, painted white inside, with front and top of heavy glass, upper part of back screened with fine mesh to keep out flies, and in the lower part a hinged door for feeding and cleaning out the waste. A small turtle will be content with a wash-basin of water with a rock island in the centre.

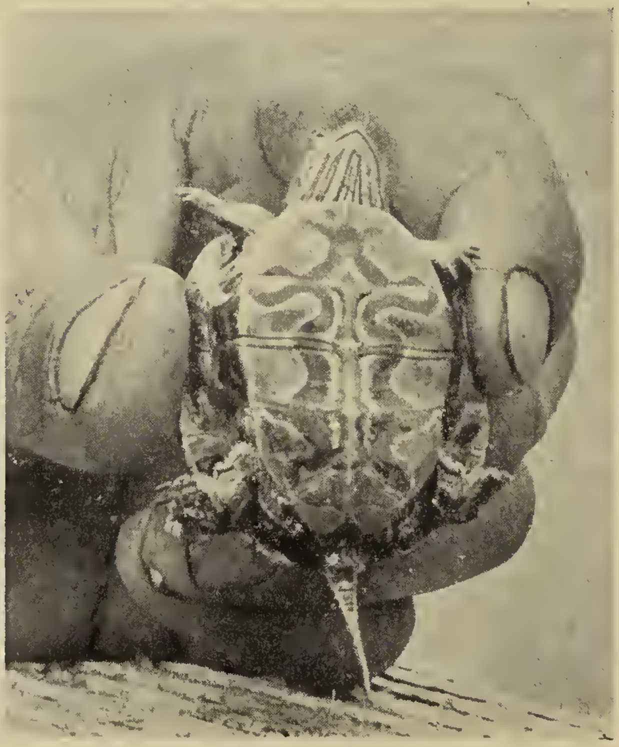
Earthworms are excellent food for nearly all small reptiles. Snakes will relish in addition, minnows, tadpoles, small frogs and toads, or a mouse you catch in a trap. Lizards take insects. Turtles will also eat scraped beef or liver, or finely ground hamburger. Some like berries or lettuce, apples and melons.

TURTLES

Turtles are a unique branch of this group. Like snails they have evolved a portable fortress home, though along very different lines. Turtles have an inside skeleton as well as this bony box, covered with horny material, on the outside. The upper shell of the turtle is called the carapace and the lower shell, the plastron. These words might be in a spelling lesson. In most cases these are rigidly joined by bone. Compare different species for size of plastron and openings. Do try to collect a Box turtle that has a plastron hinged transversely across the middle so the box can be shut tightly.

When a creature's lungs are enclosed in a rigid bony box with no movable ribs, breathing becomes a problem. Turtles solve this by inhaling air through the nostrils into the mouth cavity and then forcing it down by means of throat muscles. You can watch the pulsations in the throat. Are the pulsations rapid and regular or slow and occasional? Do you think a turtle needs as much oxygen as a bird or mammal? Why?

Turtles have an adequate sense of smell and of taste shown by their choosiness about food.



Is any child keen-sighted enough to catch the motion of the two main eyelids plus the third one, a transparent "nictating membrane", camera-shutter-fast, which we will meet again in the birds? What eye colours do you find in turtles?

Do any turtles have teeth or just a sharp horny ridge on each jaw? Which of them will eat only when they have taken the food under water? If the morsel is too large to swallow, what does the turtle do about it?

Are the number of toes the same on all feet and for all turtles? Are they all clawed? Are they always webbed? Put one in a pan of water and find out how it swims—legs in unison or alternately? How does it steer?

Encourage the children to haunt the banks of streams and ponds in June when they might manage to see a turtle dig a nest and lay its eggs in the sand. Turtle races would be fun!

Discuss with your class which local snakes are poisonous, if any, and the many ways reptiles are useful to man, as food, tortoise shell, alligator skin, and as destroyers of rats and mice and insects. Think up others.

CLAY MODELLING

A project of proven success was described in *Canadian Nature,* September 1939, p. 42; here it is in full:

"Most children like turtles and many have pet baby turtles, so turtle modelling is usually very popular. Start with a marble game to show the simplicity with which turtles may be modelled. The children are asked to make four clay marbles, a small marble, two alleys, and a large shooter.

ORDER OF PROCEDURE

1. Take the smallest alley, place in palm of hand, and slap with the other hand to make a "pancake".

2. Take large shooter, flatten slightly, then pull out four thick corners. Place on pancake and press slightly.

3. Take one of the alleys and roll to pencil shape; sharpen end by rolling and on opposite end make a definite indentation all around the pencil where the rubber would be. Place clay pencil on top of the two pieces already put together.

4. Take fourth marble and flatten into a pancake and place on top of the other three. Press slightly so that the four pieces of clay

will stick together. The result is an amusing model with the general appearance of a turtle.

If possible, show the children a real turtle, if not possible, a picture can be used. Have them notice the shape of the head, how the eyes are placed, the peculiar shell, etc. Notice the plates that form the shell. The children can quite easily change their original model into quite a lifelike turtle. With tempora paints have the children paint in the distinctive colour markings of the particular kind of turtle studied. Shellac the model and later varnish with clear varnish. After the marble game, the children can quite easily model turtles of any size. In natural history modelling, our aim should not be to achieve a perfect model but to develop a lively interest in the animals and to have fun doing it. Natural history projects must be fun, not work.

Book Helps

Make available to the children a book with good pictures of the Dinosaurs that flourished in the Golden Age of Reptiles, an era that ended over 50 million years ago and lasted over 100 million years. Makes this year seem a drop in a bucket, doesn't it?

Birds

That birds are among the most precious of all nature's treasures, many of you will agree. Their colour, their songs, their liveliness, all give intense pleasure. Take a group of children on bird hikes. As you gain experience together you will begin to see much more than brown-grayish tails disappearing behind a leafy screen, or a transient flash of blue or yellow. There are several ways to approach this highly intriguing and rewarding hobby of knowing birds. Start with the home-grown varieties, chickens, ducks, geese, canaries or love birds, and kindle, through close contact with them, an interest in bird structures.

Feathers

The higher we climb on the evolutionary ladder, the more exciting are the new developments. Birds are said to be the first living things to be able to maintain an even body-temperature regardless of the temperature of the environment! This is due partly to the greater oxygen-carrying capacity of their blood, to a more delicate nerve-control regulating the flow of blood to different parts of the body, and to the very important development of feathers which form a nearly perfect insulation to retain the body heat. Feathers are amazing structures, confined to birds alone of all animals. Make a collection of them—the strong flight feathers of wings and tail with their barbs hook-and-eyed together, the softer, looser, body-contour feathers downy at the base, down with no barbs at all, and the filoplumes "thread-feathers" which housewives call hairs and singe off before cooking. They aren't hairs (hairs are restricted to the mammal group) and under a hand lens you can see that the outer end is divided into several branches which the children will like to see for themselves. Ruffle a flight feather into disorder and then hook-and-eye it together again between your fingers as a bird can by drawing it through its bill. Examine a plucked hen and discover that birds are feathered only in certain limited areas. That may surprise you.

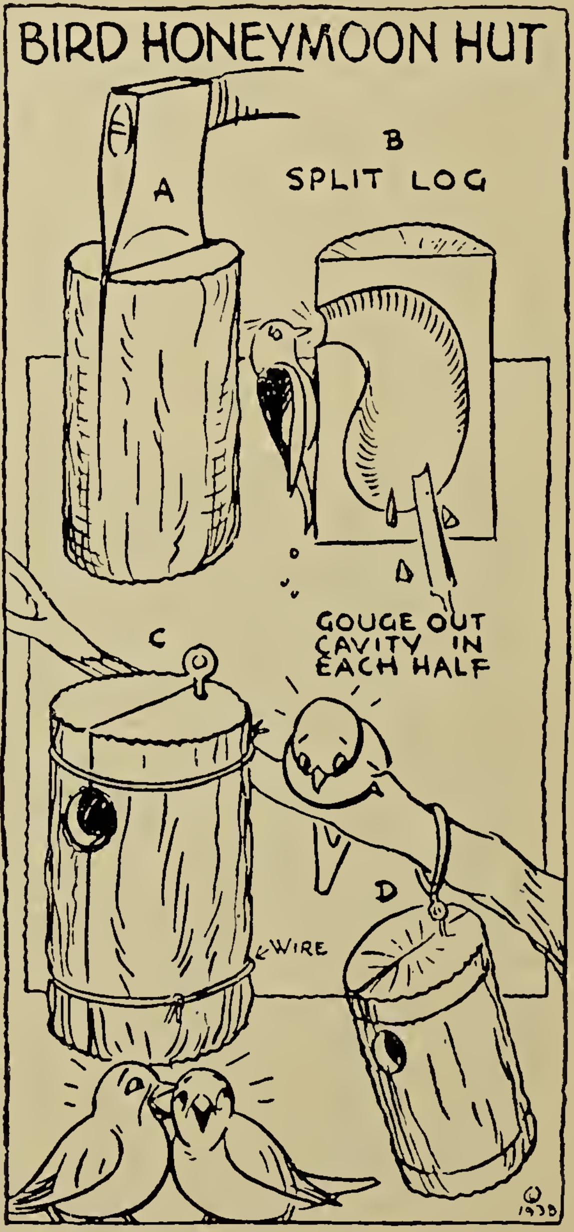
Flight

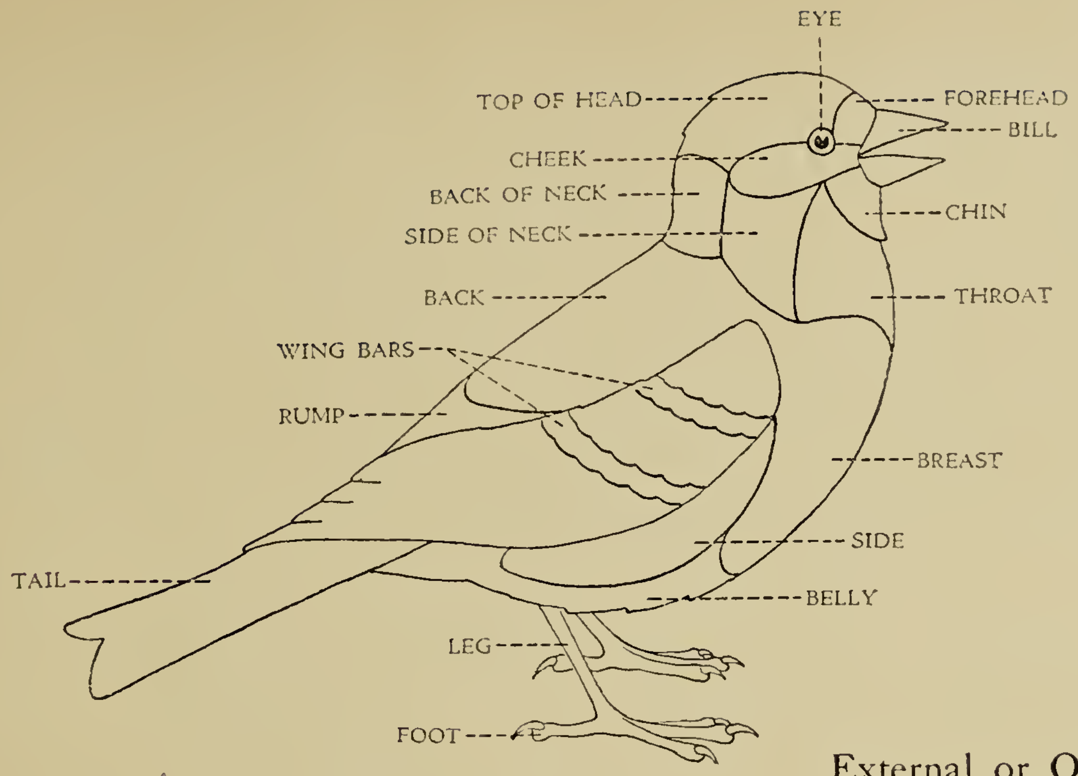
Insects appeared before birds and achieved flight but their wing mechanism has no relation to their legs and could sustain only very small creatures. Bird wings are front legs modified for flight and can sustain a creature as large as the California Condor with a wing-spread up to 9½ feet.

The bird skeleton is also greatly modified to make flying easier; many bones are hollow for lightness, others welded together to provide firm anchorage for the powerful flight muscles.

Toes

Then there is the interesting matter of number of toes and how many point forward and how many back. Notice the difference in position on the perch between a canary's toes and a love bird's or parrot's. How many toes are joined by the webbing in the case of ducks and geese?





External or Outside Parts of Bird

And where is a bird's heel? Once when I asked that question of a group, a little girl flashed back, "Oh I know, it's way up its leg". That sounded funny, but it is, in a manner of speaking, true. The foot is part of what seems to be the leg; only the toes rest on the ground.

How does a bird stay on the perch while asleep or in a gale of wind? Did you ever think of that? It locks itself on by squatting down. You can demonstrate this with a chicken leg the next time you prepare a hen for a fricassee. Tendons clamp the toes fast about the roost when the bird's leg is bent at the joints, and the bird can't get them loose until it stands up straight. Try it and see!

EYELIDS

It's fun too, to observe the eyelids. You shut your eyes down, a bird shuts its eyes up. It is their lower lid that does most of the moving. Their winking is done with a third, thin, translucent eye-lid, called a nictitating membrane, which shoots across the eye from the inner corner with camera-shutter speed. This is easy to watch in a hen or duck, harder in a canary. We observed this in amphibians and reptiles.

BIRD TOPOGRAPHY

A very important help in seeing correctly the location of colours on birds is knowing the elements of bird topography. Have a large chart of a bird in the schoolroom and let the children make a labelled copy. Then they won't report a Myrtle Warbler having a yellow back or a yellow tail when it has a yellow rump.

FEEDING TRAYS

While you are getting these close-ups of bird structures, it is time to begin attracting wild birds by putting out feeding trays for them, and an excellent time to do this is in the winter when the birds need your help. Trees and shrubs are bare, so you can see the birds better. Also there are fewer birds about, which is less confusing. A feeding tray protected from the weather on all but the lee side will surely be appreciated. If you provide pieces of clean suet, sunflower seed, crumbled cornbread that is greasy, raw rolled oats rubbed with peanut butter, chopped nut meats, apples cut in two, raisins, and a banana with one section of peel removed, you'll attract every bird in a wide area. At close range getting to know them is easy.

GROUPINGS THAT AID IN IDENTIFICATION

Here are five helpful ways of grouping birds: (1) by seasonal presence, (2) by size, (3) by colour, (4) by habitat, (5) by feeding area.

Seasonal presence divides into (a) resident all year round, (b) winter visitors only, (c) summer residents, nesting, (d) migrants passing through, these include many warblers, loveliest of all but difficult to identify, so don't begin with them.

You can group birds roughly according to size, for example, those which are the size of a hummingbird, a wren, a sparrow, a robin, a crow, or a hawk.

List the predominating colour and also striking patches of bright colours, noting exactly where these are situated.

Habitat is where the bird is generally found, for example, (a) on or near water, (b) on the ground, (c) in open fields, (d) in brush, (e) in wooded areas, (f) skimming through the air.

The feeding areas are (a) in the water, (b) on the ground, (c) on low plants or shrubs, (d) on tree trunks, (e) tree limbs, (f) outer branch tips, (g) tree tops, (h) skimming through the air.

Just for fun, try to place each bird you see in his proper "pigeonhole" in each of these five major divisions. You'll have all kinds of exciting adventures trying to fill in the blanks in your information about a new bird on your list.

If you have a good ear for music, identification by song and call note is the easiest and surest for you hear clearly a score of birds for every one you see distinctly. A friend who already knows bird songs is a tremendous help in this.

Familiarity with coloured pictures of birds will help greatly to solve the problem, but don't use bird pictures as a substitute for knowing live birds in the field.

Water Birds

If you are fortunate enough to live near rivers, lakes or ponds where water birds congregate, these areas offer an excellent opportunity for bird study. Generally water birds are larger, are stationary for longer moments, and often have striking colour patterns which make them easy to identify.

A member of my own local Audubon Club has a small telescope, with tripod, which he takes on all our water bird excursions. It is powerful enough to show minute detail on a fairly distant bird. You may be able to enlist a telescope owner on your behalf.

Migration

Bird migration is an intensely interesting study. On a large map of North and South America you could indicate the migration routes of all the migrants that pass your way, and show their northern and southern limits.

Adaptation of Bills and Feet

Another fascinating project is the study of bills and feet as adapted to the kind of food preferred. Eagles and hawks have a strong, hooked beak and sharp talons for grasping and tearing live prey, while the vultures, that eat flesh which they have not themselves killed, have bills like a hawk's but feet like a turkey's. This field is too rich and too wide for full discussion in this article. Consult "Legs and Bills" by Arthur Nelles in *Canadian Nature,* May 1948, pp. 90 and 91.

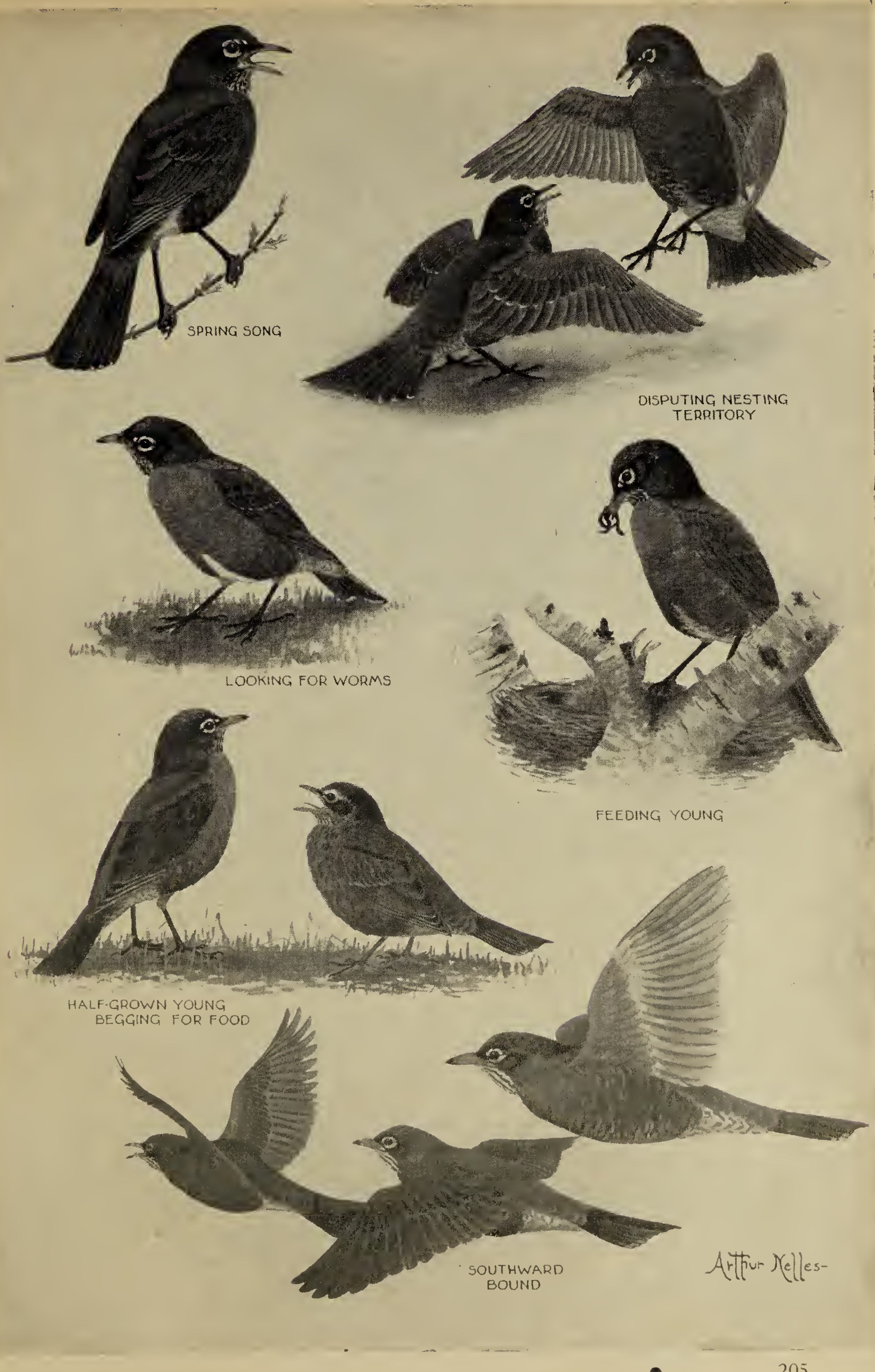
The Robin

I hope you all have in your gardens "a tree which may in summer wear a nest of robins in her hair", for a robin is a delightful bird to watch hour upon hour. It likes to share our gardens and lawns and yet is so cocky and spirited and independent about it.

If you haven't a robin, select a house wren, or starling, or even a pugnacious house sparrow or whatever bird does nest in your garden and make observations on that, to compare with the discoveries of the robin watchers.

Observations on Nesting

Nesting season is the ideal time to go about it, for then your birds are anchored to one spot and easiest to watch. You'll want to discover where the nest is placed, what it is made of, whether both parents help build it, how the parents differ in colour, the colour and number of eggs and how frequently they are laid, whether the male feeds the brooding female or shares the brooding job with her, how long before the eggs hatch, how long before the babies leave the nest, and how the babies differ from the parents in colour pattern. In the case of robins be sure to notice the spotted breasts of the babies—hallmark of the thrush family to which robins belong. The babies look rather bigger than the parents but only because their feathers don't lie so trimly smooth. However, the tails are shorter. Watch the tails grow longer day by day if they linger about your garden as they usually do.


SPRING SONG
DISPUTING NESTING TERRITORY
LOOKING FOR WORMS
FEEDING YOUNG
HALF-GROWN YOUNG BEGGING FOR FOOD
SOUTHWARD BOUND
Arthur Kelles-

There are other matters to observe, such as disposition, songs and call notes, whether there's a second brood, seasonal change of plumage by moulting, and, most fun of all, food, food getting, and table manners. My robins have been very partial to earthworms and insects specially for feeding their youngsters, but berries and many other fruits are also favourites. I can't remember ever seeing them eat leaves or buds or seeds. What do your robins eat?

One never tires of watching a robin's stop-look-listen method of stalking earthworms. First, a head-erect-watchful-for-danger pose, then head stretched low and forward, cocked to one side, listening, then a lunge forward of the entire body that buries the bill full length in the soft earth. A jerk back shows the tip of an earthworm caught in his bill. I have counted as many as thirty tugs to get the earthworm out. Sometimes the tugs are alternated with straight steady pulls which tire out the earthworm's weaker muscles. I once got a close-up view as a robin pulled out a six inch worm. Did the robin cut it in pieces? He did not! He laid it on the ground, took one end in his bill and with half a dozen tosses of his head swallowed the worm in three or four seconds. Fast work! It reminded me of a line in a nonsense nursery jingle, "How it tickles when it squirms!"

Another time I saw a robin tumble right over backward he tugged so hard and the worm came free so suddenly. Have you ever seen a bird apparently chagrined? This one was!

Close watching of any available bird yields a rich harvest of interest and fun and beauty. Try it!

AUDUBON JUNIOR CLUB SUPPLIES. Birds will soon be coming back, flowers opening, new leaves appearing—the whole countryside will be filled with young birds and other animals. Each day the outdoors will grow in interest. Form an Audubon Junior Club now and introduce your class or youth group to the fun of outdoors exploration—around their homes, in the park, in the country. You can use Audubon Junior Clubs to teach CONSERVATION—geography, English, natural science, art, social studies. Ten children of any age plus an adult adviser (the teacher or youth leader) constitute a club. The adviser sends dues of 15 cents for each child member, plus $1.00 registration fee to Audubon Society of Canada, 177 Jarvis St., Toronto 2, Ontario. Illustrated folder giving full details sent on request. Clubs may enroll at any time during the school year.

Mammals

MAMMALS, like birds, are warm-blooded, but with mammals appear two more innovations in the evolutionary picture, hair as a covering, and milk to nourish their young. They all breathe air by means of lungs. Even the mammals that live in the sea, as whales and porpoises do, have to come to the surface for air. Whales use a thick layer of fat (blubber) to hold in their body-heat and have very few hairs left. Tropical elephants have very little hair too, but their northern relatives, the prehistoric mammoths, were very hairy as was proved by some found frozen and perfectly preserved in Arctic ice.

There is great diversity in size in mammals from the tiniest shrews and mice to a 100-foot whale or a 4-ton elephant.

DIFFERENT HABITATS

Mammals live in many kinds of places, as whales in the sea, semi-aquatic beavers, bats that fly through the air, the flying squirrels that are gliders not true flyers, moles that live underground, hundreds of animals that live on the ground, and some few which spend most of their time up a tree. An extreme example of the last is the South American sloth which never voluntarily comes to earth where it is all but helpless. Set the children discussing the ways in which the mammals' bodies are fitted for life in these various habitats.

OFFENSE AND DEFENSE

In what way are different mammals equipped for offense and defense? How many can the children think up? Teeth, claws, hoof, horns, swiftness, quills of the porcupine, odoriferous flit-gun of the skunk, "shell" of the armadillo, highly developed sense of smell—these and many others.

TEETH AND FOOD

Have a lively discussion on the adaptation of teeth to the kind of food preferred—the sharp, tearing fangs of the flesh eaters, the flat grinding teeth of the vegetarians, the chisel-like front teeth of the rodents, as in beavers, and their grinding rear teeth. Examine pets and visit a farm and a zoo if possible to discover first-hand these adaptations instead of merely reading about them. What is odd about a cow's front teeth? I had seen skulls of many mammals in a college laboratory and used to wonder how rodents could chew their food because, when the chisel-like front teeth meet, the grinders behind do not. A pet gopher gave me the answer. It bit off pieces of carrot with its chisel teeth and then shifted its jaws so the chisel teeth overlapped and this permitted the grinders to come together and chew up the carrot. It was fun to make this discovery myself. I'm thoroughly convinced that it's what you discover yourself, by watching, that gives the biggest thrill in a nature project.

Toes

How many toes has a horse, a cow, a dog, a cat, a skunk, a bear? Which walk on their toes and which are flat-footed? I rarely find a person who knows how many toes a dog or cat has, even when they've had them as pets for years. Check on that.

Tracks

This leads to the delightful project of animal tracks in snow, mud, dust, or wet sand. Don't stop with mere identification of them. Try to read the story of what happened; it is sometimes very dramatic.

Which mammals have claws, which have nails, and which have hoofs?

Pupils of Eyes

There is the question of shape of pupils of eyes. This led to one of my unique adventures for I read in a book that lions, being in the cat tribe, have eyes like cats, with a vertical lens-shaped pupil. This was before I learned not to swallow whole what I read in books, so I put this in a mimeographed guide "What to look for in a zoo" and, with a group of children in tow, headed for the lions' cage.

Imagine my consternation when we looked the lions in the eyes and found their pupils just as round as our own! That started me off, and I have looked in the eye of every member of the cat tribe in all the zoos on the Pacific Coast. I found zoo superintendents most cooperative because they too had read what I had read, and were equally eager to learn the truth. Many a feline has been roused from a comfy snooze and given an "off the record" scrap of meat so we could get a good look. The only felines I've ever found with cat-like eyes are ocelots and two species of lynx. The other lynxes had round pupils as had tigers, leopards, and all other felines I saw.

Later, still more excitement was added when I chanced to discover that foxes (they are in the dog tribe, so you would expect them to have eyes like dogs) have the slitty, vertical pupil of the cat! See for yourself and if you find something different, write *Canadian Nature* about it. The world is full of surprises!

There's a third pupil shape, easily seen in a goat, less easily distinguished in the dark-brown eyes of horses and cows. It's a horizontal, narrow rectangle, but with slightly curved corners. See it for yourself. Can you find any other shape of pupil in mammals?

Colour of iris makes a postscript to your pupil-shape project.

Which mammals are cud-chewers? It's fun to watch the cud move up and down the neck as the animal unswallows and swallows it especially in the case of a giraffe with six feet of neck. That is something to watch!

Uprisings and Downsittings

Do you know which end of an animal gets up first or goes down first when it starts to get up off the ground or when it begins to lie down? Watch horses, cows, sheep, goats, pigs, dogs, and cats, and compare notes.

Fruitful Topics for Investigation and Discussion

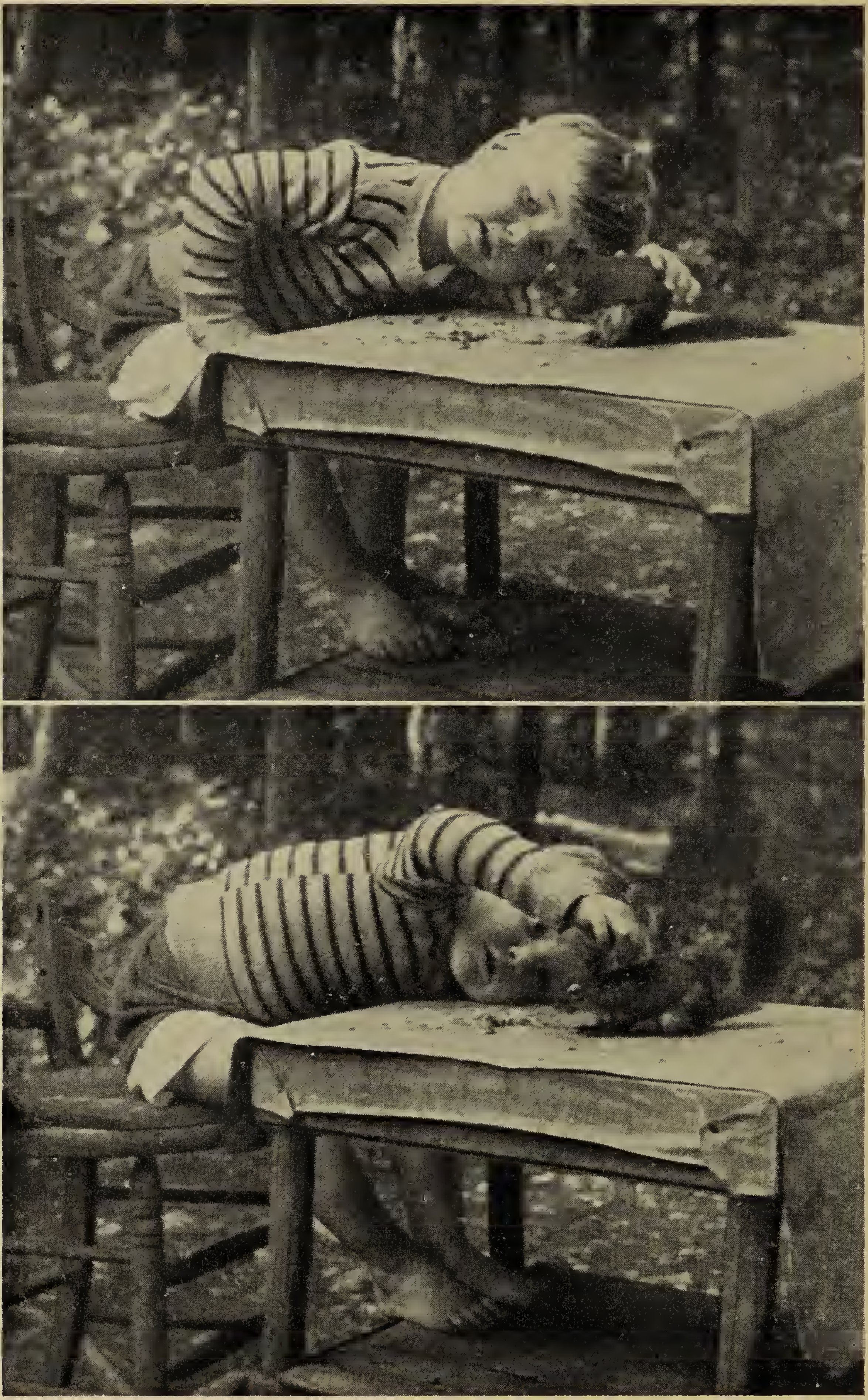
1. What mammals has man domesticated? 2. Which are the game mammals in your part of the country? 3. Which mammals are hunted for their fur in northern North America? During what season are the pelts prime? 4. What is being done in your part of the country to bring back to normal numbers the mammals that have been nearly exterminated? Can you get a hunter and a trapper to talk to the children about their experiences? 5. In how many ways are mammals useful to man?

Observe Kindness-to-Animals week all the year round.

Adventuring with Squirrels

Can you imagine a jollier mammal project than to make friends with squirrels? They are common in many of your parks and woodlots and are easily induced to come to the feeding tables you set up for them and sometimes even condescend to nest in a squirrel box, like an over-size bird house, placed in

DOE AND FAWNS



VANCOUVER ISLAND CHUMS

a tree. Do manage to put a feeding table and a nest box within range of a schoolroom window. Try a wide variety of food, seeds, grains, berries, fruits, acorns, and, of course, many kinds of nuts—but *not* peanuts for they are harmful to squirrels—and see which kinds they prefer. They are said to like maple syrup, so give them a maple sugar treat occasionally and see whether they seem to appreciate it. Quite likely some birds will think the food is meant for them; what do your squirrels do about *that?*

Watch them run up and down trees. Do they invariably go head first? York Edwards, in a delightful article about the Red Squirrel in *Canadian Nature,* May '46, page 84, tells of seeing a squirrel struggling to carry a pine cone up a tree and finally succeeding by backing up with it. Do you ever see your squirrels back up a tree? Do you find that your squirrels seem to have favourite routes both on the ground and travelling through tree tops or do they go a different way each time?

Study their foot prints in snow or dust or mud and you'll discover that, like other tree-dwelling rodents, they plant forefeet parallel, not diagonally as ground-dwellers do.

How many uses does your squirrel find for its tail?

Gray squirrels seem so widespread because they are active during the day and you see them about. But there are also a great many Flying Squirrels in central and south-eastern Canada which you rarely see because they are active only at night. Do read the article about them in *Canadian Nature,* March '48, page 63, which suggests the fascinating adventure of carrying a stout stick on your woodland rambles with which to rap sharply on any tree that looks as if it might be hollow and house some Flying Squirrels. If you are successful, the startled squirrels pour out, sometimes in large numbers, not to fly but glide to the ground, run up another tree, and glide again. I do hope you try it and meet with sensational success.

SEAGULLS AT CORDOVA BAY, B. C.

SECTION FIVE

Seasonal Activity Suggestions

J. A. Partridge and D. E. Farwell

EARLY AUTUMN

Home and School Yards. Children are entitled to beautiful surroundings; and environment speaks louder than words. Begin with a survey of the grounds—every nook and corner—to plan a clean-up. Assign definite responsibilities to different groups; mowing the lawn and discarding the cuttings; removing all weeds and rubbish from shrubs, flower beds, playgrounds—even from hidden corners and the adjoining roadside.

Plan for spring improvement. Visit other schools, and consult a capable adviser for ideas. Start a home-ground improvement campaign, having pupils report accomplishments. Enlist the help of ratepayers, trustees, Women's Institutes, etc. Have pupils write and deliver invitations to a bee for necessary grading, replacing or enriching soil, preparing new planting areas for spring, erecting or renewing arbours, flagpole, etc. Prepare for some beauty in early spring by planting bulbs in clumps or designs.

Enjoying Nature's Garden. Nature spreads her wealth of beauty before us in many forms—trees, shrubs, vines, plants with flowers and without—and they are all ours and our pupils' to enjoy and to appreciate. Use "Autumn Colours" as a central theme for such pupil activities as: recording, with dates, the changing colours of a selected tree; listing all common kinds of trees of the locality and after each, naming its characteristic autumn colours; finding what three colours other than green are most common in an autumn landscape; using pressed coloured leaves to form the letters of the word "Autumn" across the bulletin board, and mounting pressed specimens beneath it to illustrate the parade of colours in autumn; making a display to show how autumn fruits contribute to autumn's colour scheme; colouring coloured leaves with wax crayons to match leaf colours, then placing crayoned side down on paper and covering with another sheet of paper, and finally pressing with a hot iron to transfer the colour to the paper.

Beautifying the Indoors. Keep the classroom well supplied with bouquets. Demonstrate: cutting flowers with long stems, and in different stages of development; stripping off the lower leaves to prevent fouling the water; selecting containers to harmonize in colour, shape, and size with the flowers; arranging the flowers loosely and naturally; achieving suitable colour effects; cutting stems daily.

Prepare now for indoor plants: transplant geraniums, begonias and foliage plants; make cuttings and start them in well moistened sand until rooted; plant bulbs and store them in a cool, dark place, the soil kept constantly moist, until roots appear beneath the pot. Grow only paper-white narcissi in pebbles and water.

Hold an autumn flower show with pupil entries such as: bouquets of different kinds of wild asters, of mixed wild flowers, of assigned colour combinations; a vase of flowers suitable for the dining-room table, for the teacher's desk, etc. Later, distribute the flowers where they can bring most happiness.

Observing Animal Activities. Make a gay quest of discovering the following: food taken by named birds; the feeding and locomotion habits of such water animals as crayfish, fish, clams, snails; the food of caterpillars; the activities of each of the following insects on a milkweed: aphids, ants, ladybird beetles, milkweed beetles, monarch butterfly larvae; how a tomato worm or a potato beetle gets its food from the plant; how a spider spins its web; what the inside of an ant's home is like; how squirrels and other mammals prepare for winter; which birds are migrating; how a corn borer lives in a stalk or ear of corn; monarch butterflies flying south.

Indoor Opportunities. Setting up an aquarium, making and stocking a vivarium for grasshoppers and crickets, frogs and toads, earthworms, ants, spiders, growing larvae; observing larvae spinning cocoons; preparing for an insect orchestra—a cage containing grasshoppers, crickets, bees and flies and kept in a sunny place—and finding out what instrument each musician plays; observing a monarch butterfly emerging from its chrysalis.

LATE AUTUMN

Exploring the Surroundings. Collect and label various rocks and fossils. Find examples of erosion by running water, stones worn smooth by water, soil carried and deposited by running water, places from which fertile top soil has been worn away making inconvenient and dangerous ravines. To show that layers of moss, decaying vegetation, and humus on the forest floor absorb much moisture, place a layer of these materials over soil in one flower pot, leaving the soil in another uncovered. Then water each equally and compare the amounts of water and soil passing through the two pots of soil.

Make a weed survey of the lawn, the playground, the roadside, a neighbouring meadow, a grain field, a vacant lot. Learn to recognize and give correct treatments to relieve poisoning by poison ivy. Find bracket fungi on dead or living trees and discover how they live without green colour.

Preparing for Winter. Find garden plants which stay green, which shed their leaves, which die down to the ground but have living roots or underground stems, which live over winter only in seed form. Examine several trees and shrubs to see the spring buds already well developed. Open a chestnut bud to find new leaves compactly folded and well protected by layers of overlapping scales. Examine the scars left by fallen leaves to see how well the wound is sealed with corky material. Examine underground stems of canna or fern for spring buds, and test the flesh with iodine to show the rich supply of stored starch. Find buds already developed on hepaticas.

Report observations concerning animals getting ready for winter by growing a thicker covering; by storing food; by preparing new homes; by migrating; by seeking protection in cave or burrow, in mud beneath a stream or in a hollow tree; by laying eggs; by spinning cocoons or forming a chrysalid underground.

Start a School Museum. In a convenient corner of the room prepare a cupboard or shelves and a table as a Nature Corner or Museum. Stock it with pictures, reference books, identification specimens and other helps, pupil collections, aquaria and vivaria, rocks and fossils, etc.—all for pupil study and enjoyment. Permit frequent visits to this corner for quiet discussion. Encourage pupil contributions. Have curator in charge weekly.

Investigating Weather. Each pupil keeps a weather calendar for two weeks, with headings planned according to grade level. In the schoolground prepare a weather station equipped with a wooden or metal weather vane, a rain gauge, and a thermometer. Use these observations and barometer readings indoors to forecast weather. Winds changing westward usually indicate clearing and fair; storms or rain may come if the wind shifts to the east and the barometer falls, when the sky looks like fish scales (mackerel sky), when a ring shows around the moon or sun, when smoke falls, or when the sun "draws water". Compare your forecasts with those in the daily paper and with weather conditions following. Observe and discuss cloud types.

Enjoying a Snowstorm. Watch snowflakes fluttering lazily downward. On cold dark clothing or on a cold gray window ledge observe their shapes, various sizes, and delicate beauty. Catch some on warm earth and watch them melt and disappear into the soil. On a cold day compare the temperatures taken above and below some freshly fallen snow. Observe which trees hold snow best. Discover the uses of snow to plants and to man. Watch how frost crystals form on windows and on the outside of a tin can containing a mixture of snow and ice covered with cotton batting.

Celebrating Christmas. Learn to recognize common Christmas trees by their needles. On a map of the world mark the sources of the ingredients of a Christmas pudding. Make a frieze showing plants used as Christmas decorations. Help the birds to celebrate by feeding them suet, seeds, etc.

IN THE WINTER

A New Year's Resolution—to continue feeding the birds throughout the winter. Birds need food and protection in January and February especially. Prepare feeding shelters and heat-producing foods for our bird friends at school and at home. Pour a mixture of crumbs, seeds, nuts and melted suet over discarded Christmas trees. Make bird houses, ready for bird friends returning in spring.

A Month With the Moon. Find the date of the new moon on the calendar. Calling this number 1, re-date the calendar for a "moon month", each number showing the age of the moon. Observe and sketch the position and shape of the moon each night at 8 p.m. until the moon is 15 days old, labelling each sketch with the moon's age. At or before first quarter notice the direction in which the moon appears to move and its position each hour of the evening until it sets. Have a group of pupils represent the sun, a smaller group, the earth, and one pupil, the moon. While singing "The Moon Goes Round the Earth", etc., to the tune "The Farmer's in the Dell", have them act out the motions of earth and moon.

Animals in Winter. Each pupil discover how one of the following is spending the winter: earthworms, white grubs, ants, potato beetles, frogs, toads, snakes, gophers, groundhogs (forget the silly superstition about February 2!), tomato worms, bumble bees, cabbage butterfly pupae, codling moth larvae, ladybird beetles, houseflies, mosquitoes, tent caterpillars, chipmunks, bats, squirrels, etc.

Make a mural, "Animals in Winter", depicting the feeding of our winter birds, the homes of winter insect forms, mice and rabbits girdling trees, animals hibernating on a hillside or in the mud of ponds, and the activities of such animals as squirrels.

Tracks and Trails. Have pupils play detective, identifying tracks and interpreting the stories told by them (fox catching rabbit). They may then dramatize the stories, or prepare a news report. Make casts of tracks as explained in the chapter "Nature Arts and Handicrafts". To preserve tracks in snow, spray them with water from a fine atomizer. When frozen, pour a batter of plaster of Paris over them. Then, when hardened, remove the plaster cast.

Keeping Warm in Winter. An enterprise. So set the stage that the pupils will want to investigate: how we get heat from the sun (understanding radiation, etc.); how homes, clothing, fuels, and food give us warmth; how birds keep warm by finding protective cover, by eating heat-producing foods (fats), by fluffing out their feathers, thus increasing their body insulation by air; how food keeps hibernating animals comfortable; how ground animals avoid frost; how snow prevents plants from being injured by sudden changes of temperature or by alternate freezing and thawing in spring.

A Winter Hike. Take helps to identify deciduous trees by their buds, and evergreens by their needles. Notice the long, pointed, needle-like buds of beech; the one-scaled buds of willows, etc. Identify birch by its white paper-like bark, and beech by its smooth, light grey bark. Notice that oaks sometimes fail to shed their leaves, and that the snow does not cling to them. Find the tracks and burrows or other homes of mammals and birds. Tell direction by using a compass, and when you return to school, make one by placing a magnetized needle on a cork and floating it in water. Your watch will show you directions thus: Point the hour hand to the sun; south is half way between the end of the hour hand and "12 o'clock". After the hike, make a winter scene on a large table, by using small trees or twigs, moss, imitation snow, plasticine models of animals.

MARCH AND APRIL

Spring is Here! Make a chart showing the increasing length of days. Account for this by observing daily that the sun rises and sets farther toward the north. Explain why the sun's rays give us more heat when they are more nearly vertical.

Sap is running! Pupils may tap maple trees, "boil down" the sap at school, thus learning about evaporation, boiling point and thermometers. Have junior pupils make a sand-table scene including tapped trees, tin foil buckets, paper sleighs, etc.

Make mural or frieze entitled: "What the Wind Does", "After April Showers", "Making Maple Sugar".

Awakening Life. Place twigs of fruit trees and garden shrubs in water to force their bloom for indoor observation and enjoyment. Use long branches, immersed deeply in water which is frequently changed. Place them in a warm place to make the flowers open more rapidly. Try forsythia, Japanese quince, common fruit trees, and horse chestnut.

Keep twigs of pussy willows and poplars in water. Observe the stamens on the catkins. Discover how wild flowers are ready to awaken and grow—having buds and a good food supply. Watch for hepatica and bloodroot in woods and by roadsides.

Record observations of moths emerging from their cocoons, groundhogs becoming active, frogs starting their spring chorus, and toads travelling to water to lay their eggs.

Keep a class diary of awakening plants in the garden—perennials, bulbs, flowering shrubs.

Make a mural or frieze entitled, "Good Morning, Nature!"

Returning Life. Assign to each pupil an investigation of one migratory bird—where and how it spent the winter, the route of its return (making a map), and the usual date of its arrival. Have the pupil give an address of welcome to his selected bird.

At the monthly meetings of the Audubon Junior Club each pupil may report his observations of one bird under such headings as: nature of place where seen, whether in a flock or alone, nature of flight, other activities, song or call, kinds of food and how obtained and eaten, site and description of nest.

Keep a diary of a bird family—nest building, egg laying, feeding of young, and time of flight. Make a frieze showing the story of a pair of birds from the time they leave their winter homes until their young are reared.

Monarch butterflies migrate, too. Watch for the first arrivals and their eggs on milkweed plants.

New Life. Spring is the time when new forms of life appear. From seeds come flowers, vegetables, weeds, etc.; from eggs come chicks, toads and frogs, salamanders, tent caterpillars, etc. From mammals are born their young.

Start garden plants in seed flats. Have pupils race to produce the first radish ½ inch in diameter, and thus discover about soils, drainage, fertilizers, the need for water and light, etc. Rear, and perhaps hatch, chicks in the classroom, demonstrating favourable conditions for their growth—space, cleanliness, exercise, right temperature, ventilation, sunlight, correct food mixture, grit, water, etc.

Operate an insect hatchery. Place twigs, bearing tent caterpillar eggs, in water so that leaves may grow as food for the young caterpillars. Observe closely how the caterpillars moult and make tents.

MAY AND JUNE

Let's Enjoy the Wild Flowers. To live with, and to appreciate nature—not to learn about it—should be the pupils' privilege. Take another hike to the woods in early May. What is the advantage to wild flowers of blooming and developing new foliage before the trees leaf out? Notice that when a trillium is picked, its leaves are taken too, preventing the plant from making food to be stored in the underground stem for the next season of bloom. That others may enjoy them too we should leave them where they grow, particularly columbine, trillium, jack-in-the-pulpit, maidenhair fern, marsh marigold, and lady's slipper. Have pupils make posters encouraging conservation of these. Using others, show that a few flowers carefully arranged are more beautiful than a large number closely packed.

In the Garden. May and June should be months of beauty, enjoyment, and work in the garden. Have the lawn raked, rolled, and kept mowed. Do not neglect unseen corners. Assign each pupil a definite area from which to keep all weeds removed.

See that all dead wood is cut from all shrubs close to the ground or to main branches. Remember that shrubs which bloom in spring should not be pruned until their bloom is passed. The soil around shrubs should be spaded carefully without injuring roots. Label each shrub as it comes into bloom. Test identification by a scavenger hunt.

Introduce one new planting scheme each year to give pupils an opportunity to plan, and the satisfaction of accomplishment. Arrange the planting so that each pupil or group of pupils has pride of ownership. Be sure that bulbs are left undisturbed at least until June 10 or until the leaves begin to die down; then remove the tops only, not the bulbs.

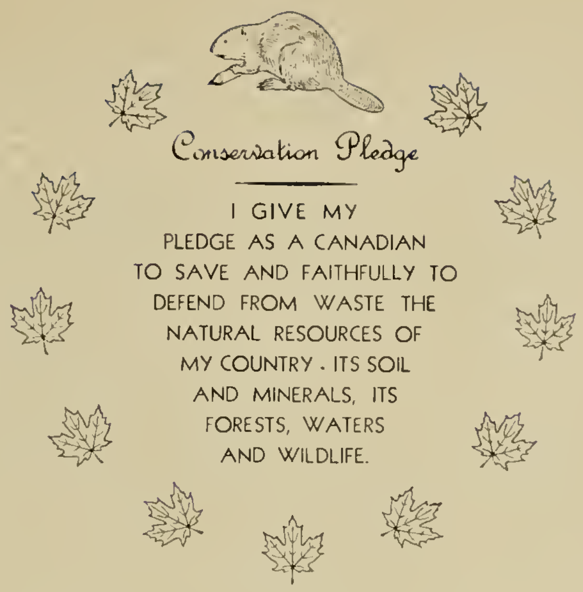
Erect bird houses for wrens and bluebirds, and put out baths.

Search for and observe: cutworms about the base of plants, bees visiting fruit tree blossoms for nectar and pollen, white grubs or May beetles, scale insects on lilac or fruit trees.

An Evening With the Stars. Armed with sky maps, flashlight, and the desire to learn, let pupils and teacher spend a warm June evening, just before the moon reaches first quarter, exploring new worlds above. Before setting out, learn the shape of such easily recognized June constellations as: the Big Dipper, the Little Dipper, Cassiopeia, Bootes, Virgo, Corona, Leo, and the Sickle. Find them in the order named. Use a flashlight to point out the stars and constellations.

A Trip to the Brook—a leisurely one. Wade in—then search for darting crayfish, creeping snails, flashing fish, skimming water striders, diving frogs, flitting insects. Observe how they feed and travel, avoid or escape from their enemies. Identify bird visitors and discover why they are there. In quiet, weedy bays look for tiny frog tadpoles, or the darker ones of toads.

What satisfaction must come to all teachers who have given their pupils a year of opportunities to so increase their first-hand contacts with nature that they may more deeply appreciate its beauty, marvel at its wonder, and respect its never-changing laws!



Conservation Pledge

I GIVE MY
PLEDGE AS A CANADIAN
TO SAVE AND FAITHFULLY TO
DEFEND FROM WASTE THE
NATURAL RESOURCES OF
MY COUNTRY - ITS SOIL
AND MINERALS, ITS
FORESTS, WATERS
AND WILDLIFE.

The 10 "Trys" of a Conservationist

I Will Try . . .

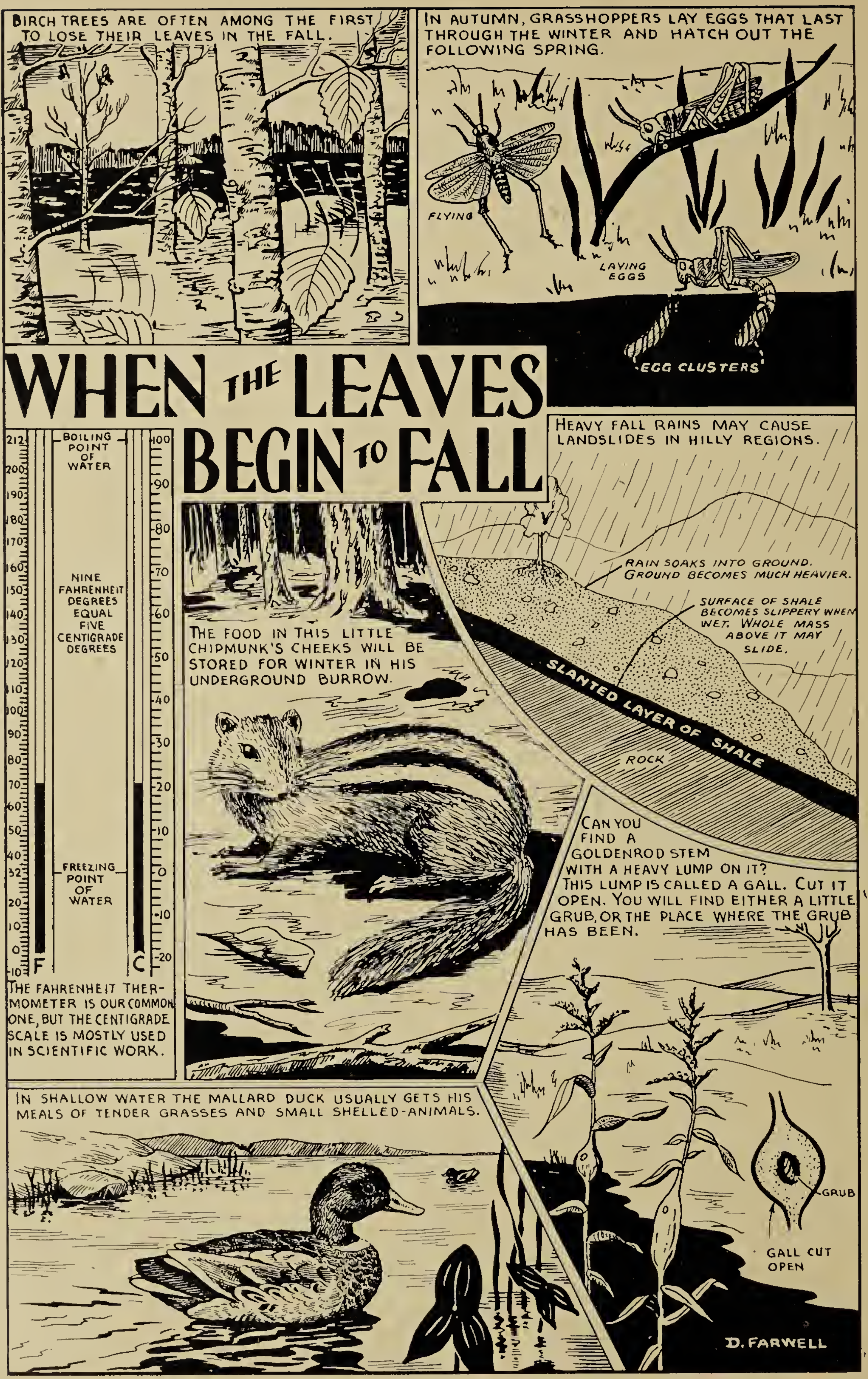
1. Never to needlessly or heedlessly destroy any life, either plant or animal.
2. To learn how to build and handle outdoor fires, so I will not be the cause of a forest fire.
3. Never to leave any part of the out-of-doors littered with papers, cans or garbage.
4. To respect the home of any living thing.
5. Never to lose the opportunity to learn more about the out-of-doors.
6. To approach all forms of wild life with the respect due them for the work they do.
7. Never to forget that I am a *steward* of all I survey.
8. To pass on to young people some of my knowledge of the out-of-doors.
9. Never to remove a tree without planting another somewhere.
10. To give my support, moral and financial, to the organizations that are truly working for intelligent conservation of wildlife in this or any other country.

—By Marie E. Gaudette

LET'S WORK FOR CONSERVATION!

You have read Conservation and Nature Activities. What man did wrong, he can be taught to do right. We can correct our own mistakes, and repair the mistakes of others. Perhaps librarians, youth leaders and teachers in your community are confused by the emphasis on conservation. Show them your copy, and encourage them to use this book. Let's all pull together for conservation, and build a better Canada!

WHEN THE LEAVES BEGIN TO FALL



BIRCH TREES ARE OFTEN AMONG THE FIRST TO LOSE THEIR LEAVES IN THE FALL.

IN AUTUMN, GRASSHOPPERS LAY EGGS THAT LAST THROUGH THE WINTER AND HATCH OUT THE FOLLOWING SPRING.

HEAVY FALL RAINS MAY CAUSE LANDSLIDES IN HILLY REGIONS.

RAIN SOAKS INTO GROUND. GROUND BECOMES MUCH HEAVIER.
SURFACE OF SHALE BECOMES SLIPPERY WHEN WET. WHOLE MASS ABOVE IT MAY SLIDE.
SLANTED LAYER OF SHALE
ROCK

THE FAHRENHEIT THERMOMETER IS OUR COMMON ONE, BUT THE CENTIGRADE SCALE IS MOSTLY USED IN SCIENTIFIC WORK.

THE FOOD IN THIS LITTLE CHIPMUNK'S CHEEKS WILL BE STORED FOR WINTER IN HIS UNDERGROUND BURROW.

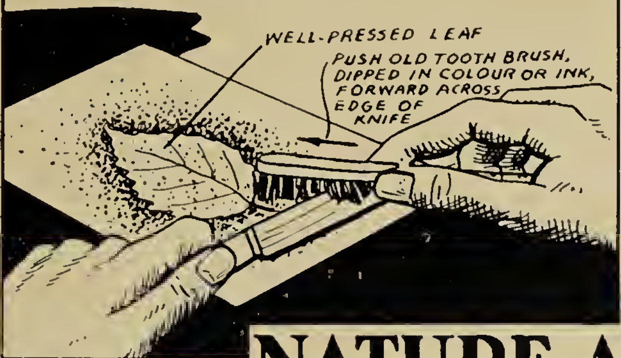
CAN YOU FIND A GOLDENROD STEM WITH A HEAVY LUMP ON IT? THIS LUMP IS CALLED A GALL. CUT IT OPEN. YOU WILL FIND EITHER A LITTLE GRUB, OR THE PLACE WHERE THE GRUB HAS BEEN.

IN SHALLOW WATER THE MALLARD DUCK USUALLY GETS HIS MEALS OF TENDER GRASSES AND SMALL SHELLED-ANIMALS.

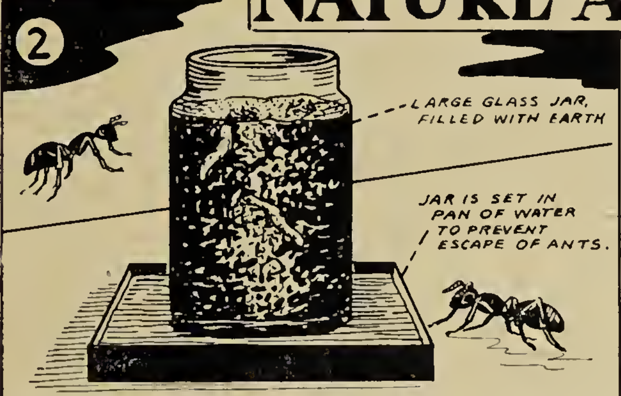
NATURE ACTIVITIES WEEK by WEEK

SEPTEMBER

① THIS WEEK GATHER LEAVES; MAKE BLUEPRINTS AND SPATTER PRINTS OF THEM. FOR BLUEPRINTING INSTRUCTIONS, SEE SEPT.-OCT., 1942, ISSUE, P. 123. FOR SPATTER PRINTS, RIGHT HERE!

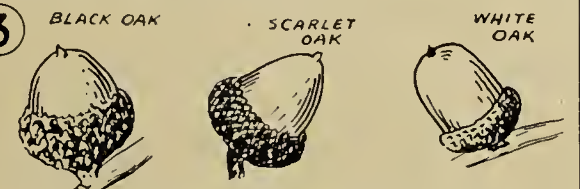

WELL-PRESSED LEAF
PUSH OLD TOOTH BRUSH, DIPPED IN COLOUR OR INK, FORWARD ACROSS EDGE OF KNIFE

②

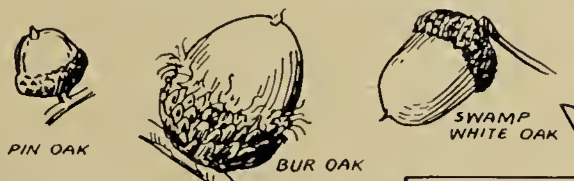

LARGE GLASS JAR, FILLED WITH EARTH
JAR IS SET IN PAN OF WATER TO PREVENT ESCAPE OF ANTS.

MAKE A SIMPLE ANT HOME AND WATCH THE TINY TENANTS AT WORK. BE SURE THAT WHEN YOU CAPTURE THE COLONY, YOU INCLUDE THE QUEEN.

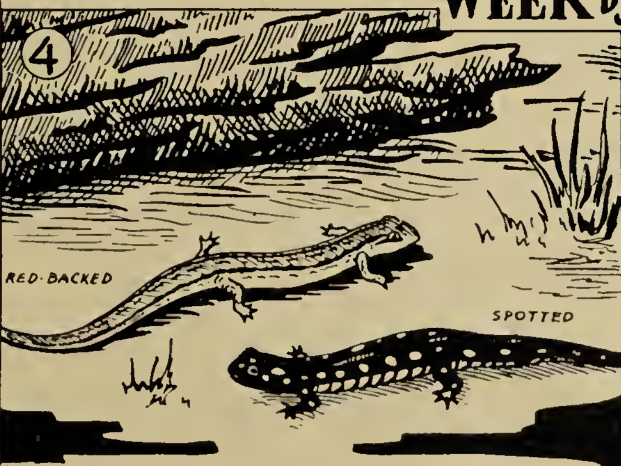
③



SEARCH UNDER OAK TREES FOR ACORNS. HOW MANY KINDS CAN YOU FIND?



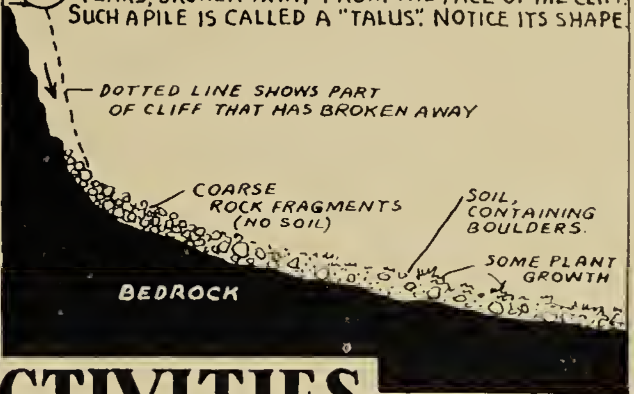
④



LOOK FOR SALAMANDERS UNDER DECAYING LOGS AND STUMPS.

OCTOBER

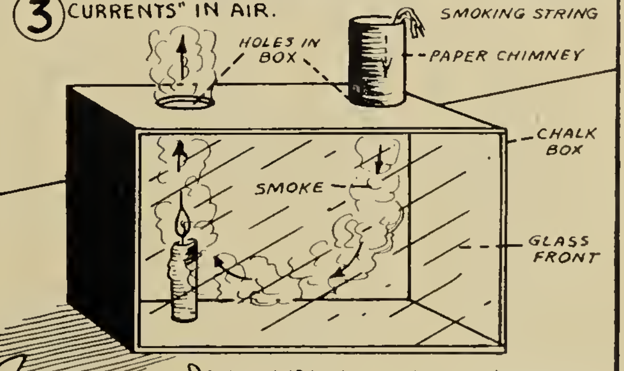
① AT THE FOOT OF STEEP CLIFFS, LOOK FOR THE PILE OF MATERIAL THAT HAS, THROUGH MANY YEARS, BROKEN AWAY FROM THE FACE OF THE CLIFF. SUCH A PILE IS CALLED A "TALUS". NOTICE ITS SHAPE.


DOTTED LINE SHOWS PART OF CLIFF THAT HAS BROKEN AWAY
COARSE ROCK FRAGMENTS (NO SOIL)
SOIL, CONTAINING BOULDERS.
SOME PLANT GROWTH
BEDROCK

② IF YOU LIVE WHERE BEDROCK COMES TO THE SURFACE OF THE GROUND, SEE IF YOU CAN FIND THE TINY LINES (STRIAE) THAT SHOW A GLACIER MAY HAVE ONCE PASSED YOUR WAY.

GLACIER MOVED IN THIS DIRECTION

③ TRY THIS EXPERIMENT TO SHOW "CONVECTION CURRENTS" IN AIR.



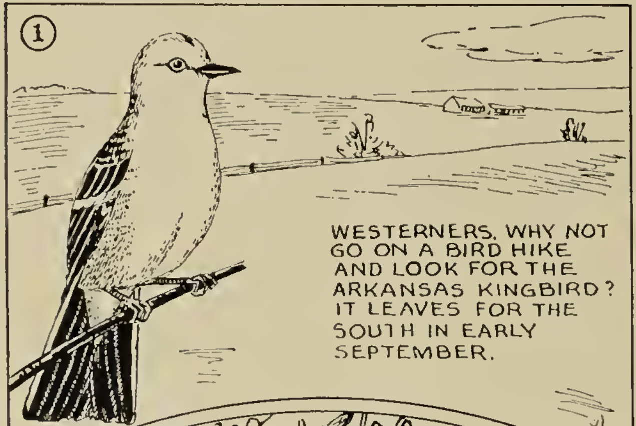
DO YOU UNDERSTAND NOW WHY THE AIR NEAR THE CEILING OF A ROOM IS WARMER THAN NEAR THE FLOOR?

④ ANOTHER "EVERLASTING" BOUQUET: TRY ARRANGEMENTS OF SUMAC WITH A FEW HEADS OF GRAIN.

(IF NECESSARY, PUSH THIN WIRES LENGTHWISE THROUGH THE GRAIN STEMS TO MAKE THEM STAY WHERE YOU PUT THEM)

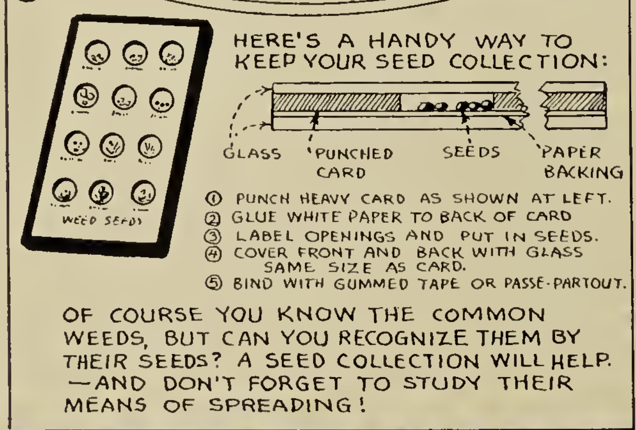
NATURE ACTIVITIES WEEK BY WEEK

SEPTEMBER



WESTERNERS, WHY NOT GO ON A BIRD HIKE AND LOOK FOR THE ARKANSAS KINGBIRD? IT LEAVES FOR THE SOUTH IN EARLY SEPTEMBER.

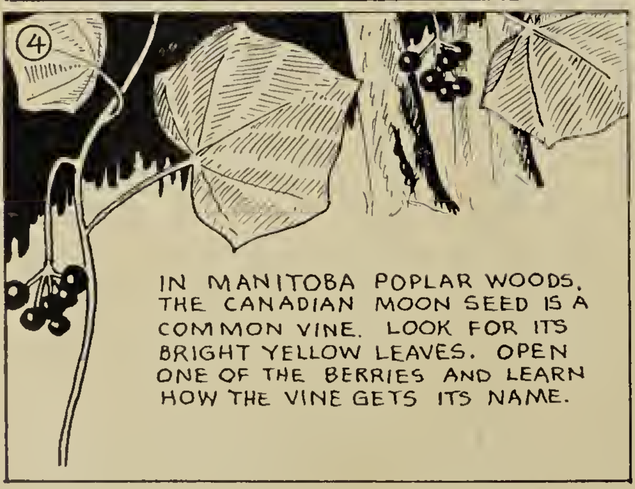
THE MONARCH IS A MIGRATORY BUTTERFLY. PERHAPS YOU MAY SEE CROWDS OF THEM GATHERING TO BEGIN THE LONG JOURNEY SOUTH.



HERE'S A HANDY WAY TO KEEP YOUR SEED COLLECTION:

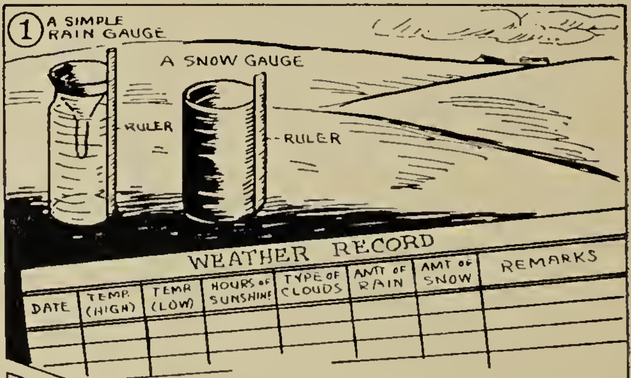
① PUNCH HEAVY CARD AS SHOWN AT LEFT.
② GLUE WHITE PAPER TO BACK OF CARD
③ LABEL OPENINGS AND PUT IN SEEDS.
④ COVER FRONT AND BACK WITH GLASS SAME SIZE AS CARD.
⑤ BIND WITH GUMMED TAPE OR PASSE-PARTOUT.

OF COURSE YOU KNOW THE COMMON WEEDS, BUT CAN YOU RECOGNIZE THEM BY THEIR SEEDS? A SEED COLLECTION WILL HELP. —AND DON'T FORGET TO STUDY THEIR MEANS OF SPREADING!

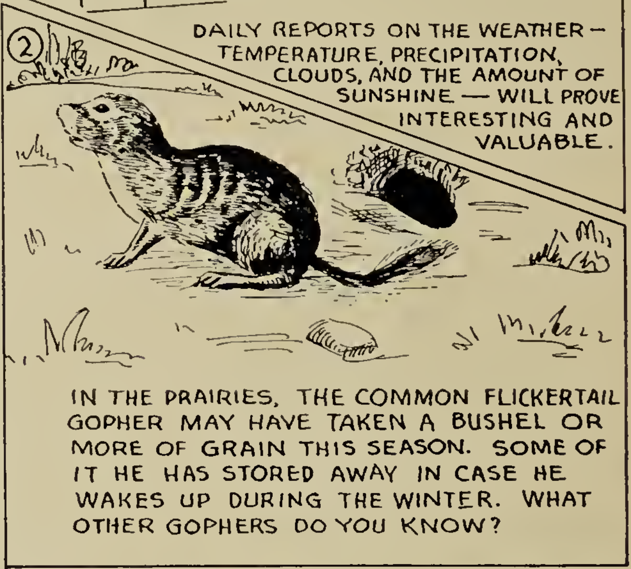


IN MANITOBA POPLAR WOODS, THE CANADIAN MOON SEED IS A COMMON VINE. LOOK FOR ITS BRIGHT YELLOW LEAVES. OPEN ONE OF THE BERRIES AND LEARN HOW THE VINE GETS ITS NAME.

OCTOBER

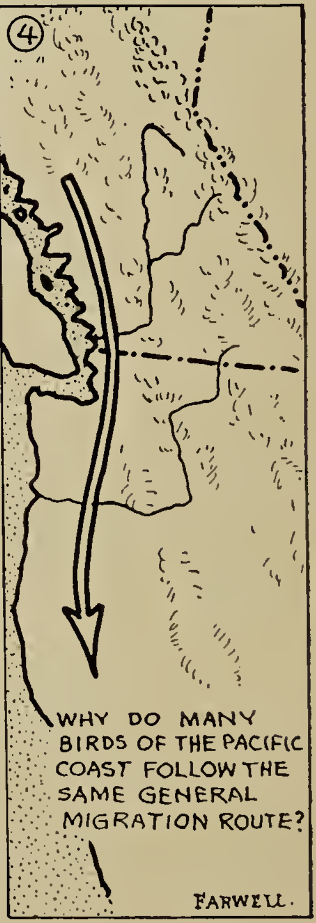


DAILY REPORTS ON THE WEATHER—TEMPERATURE, PRECIPITATION, CLOUDS, AND THE AMOUNT OF SUNSHINE — WILL PROVE INTERESTING AND VALUABLE.



IN THE PRAIRIES, THE COMMON FLICKERTAIL GOPHER MAY HAVE TAKEN A BUSHEL OR MORE OF GRAIN THIS SEASON. SOME OF IT HE HAS STORED AWAY IN CASE HE WAKES UP DURING THE WINTER. WHAT OTHER GOPHERS DO YOU KNOW?

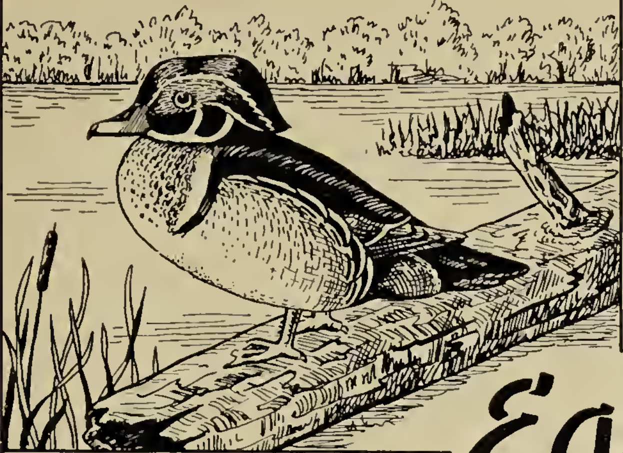
"WHY IS THERE NO EASTERN EQUAL TO BRITISH COLUMBIA'S LARGEST TREES?"
A DISCUSSION WILL BRING OUT MANY POINTS OF NATURAL SCIENCE.



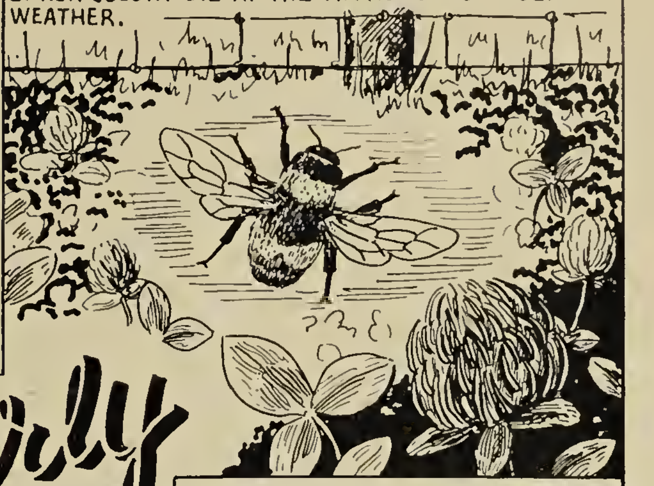
WHY DO MANY BIRDS OF THE PACIFIC COAST FOLLOW THE SAME GENERAL MIGRATION ROUTE?

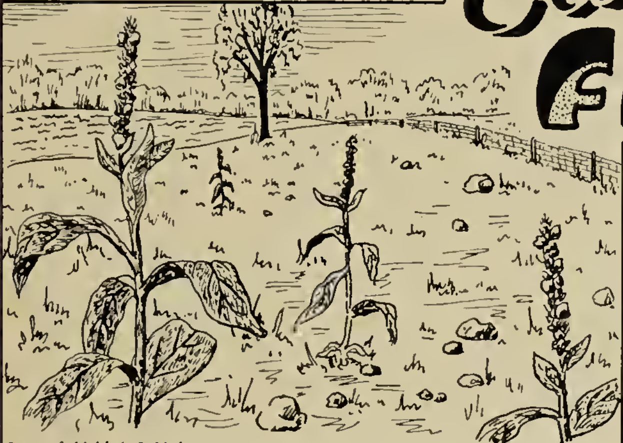
Early FALL

THE GAILY-COLOURED, CRESTED **WOOD DUCK** HAS BEEN CLASSED AS ONE OF OUR VANISHING SPECIES. TO SHOOT HIM IS UNLAWFUL IN MANY PARTS OF THIS CONTINENT.



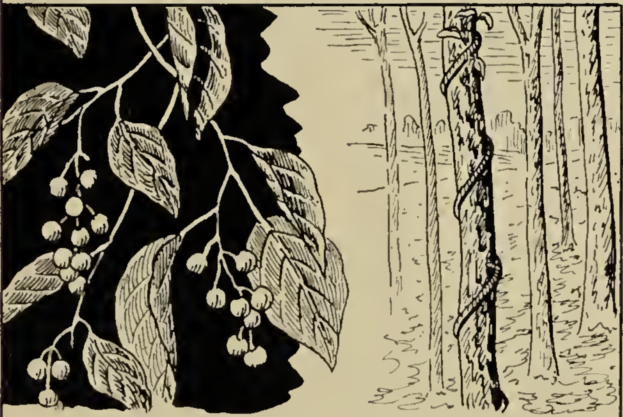
THE QUEEN **BUMBLEBEE** MATES IN THE AUTUMN AND HIBERNATES OVER THE WINTER. THE OTHER MEMBERS OF HER COLONY DIE AT THE APPROACH OF COLD WEATHER.



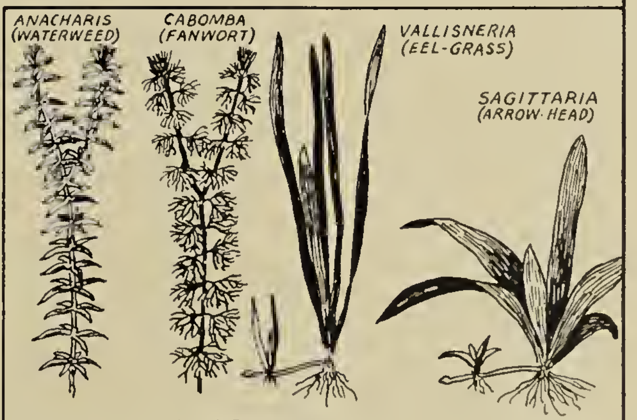


THE **MULLEIN** IS A WEED COMMON IN GRAVELLY OR SANDY PASTURES. SINCE IT DOES NOT WITHSTAND CULTIVATION, IT CAN BE CONTROLLED BY A SHORT ROTATION OF CROPS.

THE SO-CALLED "CHICKEN" HAWK, OR **RED-TAILED HAWK**, SELDOM RAIDS A CHICKEN-YARD. MICE AND OTHER SMALL ANIMALS FORM ITS PRINCIPAL DIET.

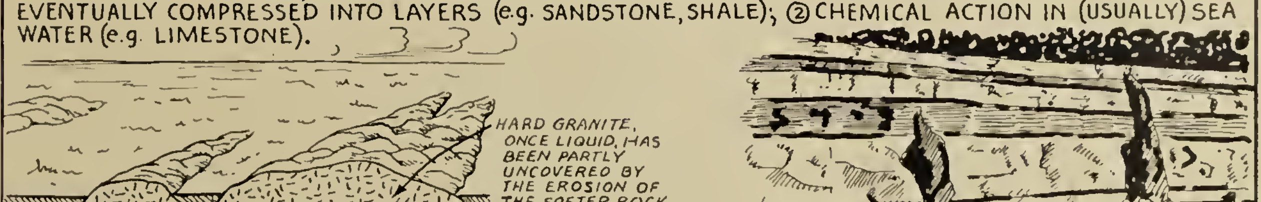


BITTERSWEET CAN BE RECOGNIZED EASILY BY ITS BRIGHT ORANGE BERRIES AND SHINY GREEN LEAVES. LOOK FOR IT ON WOODLAND BORDERS.



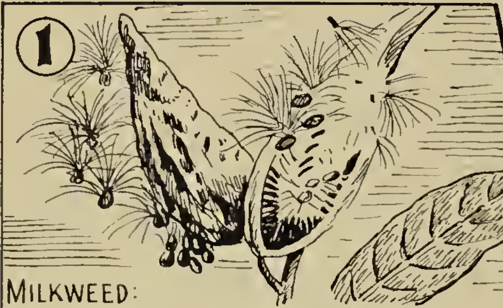
FOR YOUR **AQUARIUM**, ANY OR ALL OF THESE OXYGEN-PRODUCING PLANTS WILL BE USEFUL. LEARN THEM BY NAME.

"FIRE-MADE", OR **IGNEOUS ROCKS** WERE FORMED BY THE COOLING OF LIQUID ROCK MATERIAL (e.g. GRANITE); **SEDIMENTARY ROCKS**, BY ① WIND AND WATER CARRYING AND DROPPING ROCK PARTICLES THAT WERE EVENTUALLY COMPRESSED INTO LAYERS (e.g. SANDSTONE, SHALE); ② CHEMICAL ACTION IN (USUALLY) SEA WATER (e.g. LIMESTONE).


HARD GRANITE, ONCE LIQUID, HAS BEEN PARTLY UNCOVERED BY THE EROSION OF THE SOFTER ROCK ROUND ABOUT.
THIS IS CALLED A BATHOLITH
D. FARWELL

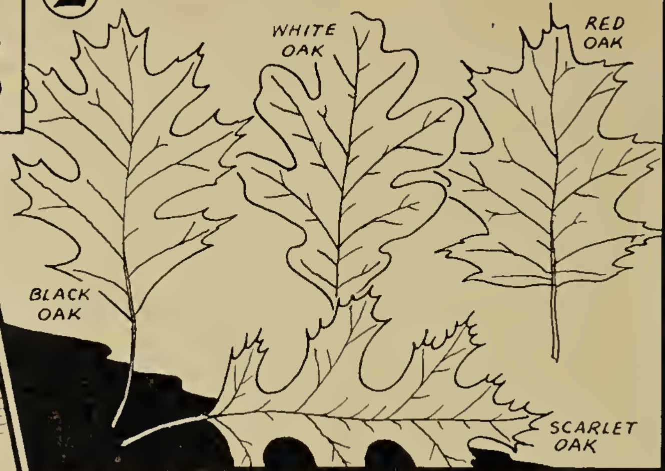
Nature ACTIVITIES

SEPTEMBER

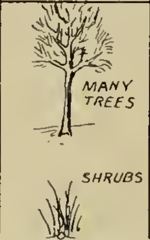
① 

MILKWEED:
THIS FORMER NUISANCE SUPPLIES TWO EMERGENCY PRODUCTS: ① A FORM OF RUBBER; ② STUFFING FOR CUSHIONS. EXAMINE THE PLANT TO FIND OUT HOW IT IS FITTED FOR THESE USES.

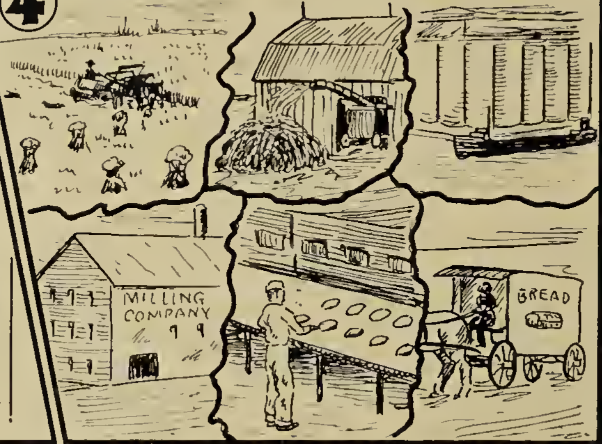
② HOW MANY KINDS OF OAK LEAVES CAN YOU FIND IN YOUR COMMUNITY?



③ A CHART ABOUT "HOW PLANTS PREPARE FOR WINTER" WILL BE INTERESTING TO MAKE THIS WEEK. COLLECT EXAMPLES.

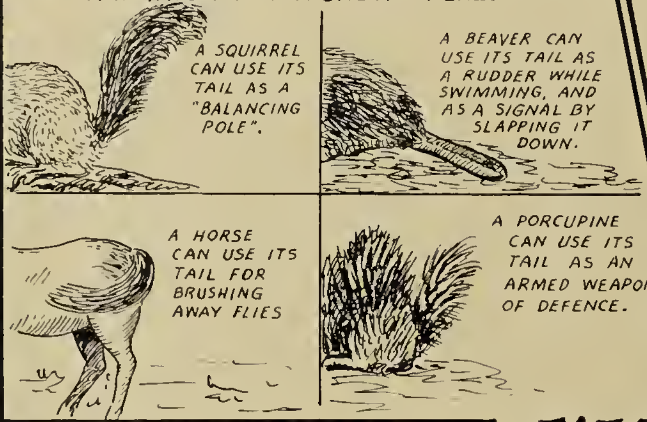
SOME SCATTER SEEDS, AND DIE	SOME DIE TO THE GROUND BUT GROW AGAIN NEXT YEAR	SOME SHED THEIR LEAVES	SOME STORE FOOD IN BULBS
PETUNIA COSMOS	IRIS	 MANY TREES SHRUBS	TULIP DAFFODIL

④ "THE STORY OF A LOAF OF BREAD" - A MURAL.



OCTOBER

① TAILS SERVE ANIMALS IN MANY USEFUL WAYS. ADD TO THE SERIES OF DRAWINGS AND INFORMATION SHOWN HERE.



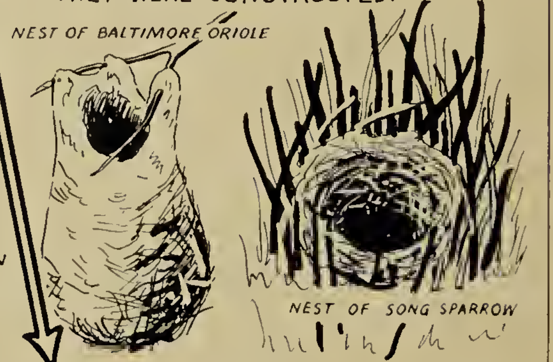
A SQUIRREL CAN USE ITS TAIL AS A "BALANCING POLE".

A BEAVER CAN USE ITS TAIL AS A RUDDER WHILE SWIMMING, AND AS A SIGNAL BY SLAPPING IT DOWN.

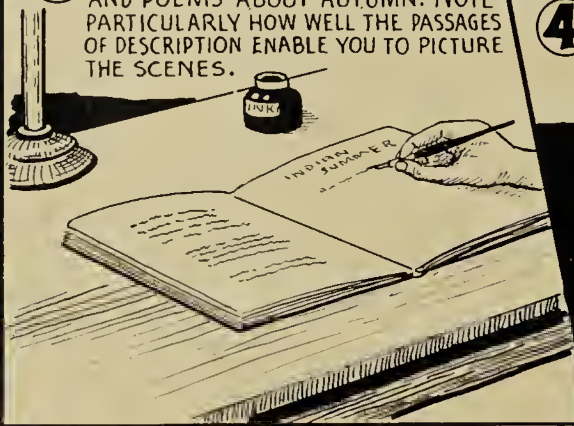
A HORSE CAN USE ITS TAIL FOR BRUSHING AWAY FLIES

A PORCUPINE CAN USE ITS TAIL AS AN ARMED WEAPON OF DEFENCE.

② NOW THAT THE BIRDS ARE FINISHED WITH THEIR NESTS, EXAMINE WHATEVER NESTS YOU CAN FIND TO LEARN HOW THEY WERE CONSTRUCTED.

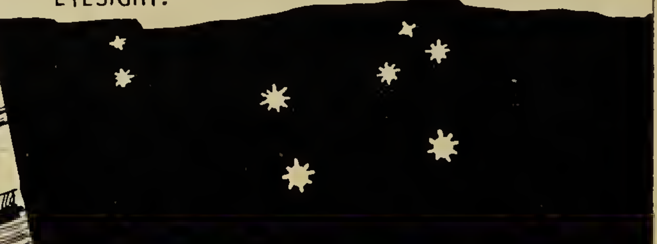


③ A BIT OF INTERESTING READING: MAKE A COLLECTION OF STORIES AND POEMS ABOUT AUTUMN. NOTE PARTICULARLY HOW WELL THE PASSAGES OF DESCRIPTION ENABLE YOU TO PICTURE THE SCENES.



WEEK BY WEEK

④ LOOK FOR THE CLUSTERED PLEIADES RISING IN THE EAST AT ABOUT 9 O'CLOCK ON OCTOBER 10. HOW MANY OF THE "SEVEN SISTERS" CAN YOU SEE? THE INDIANS USED THIS STAR GROUP AS A TEST FOR GOOD EYESIGHT.



THIS IS BUT A SMALL GROUP OF STARS. LOOK CAREFULLY.

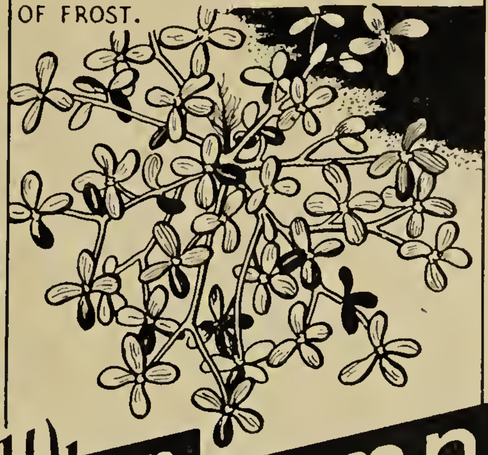
D. FARWELL

When AUTUMN Comes

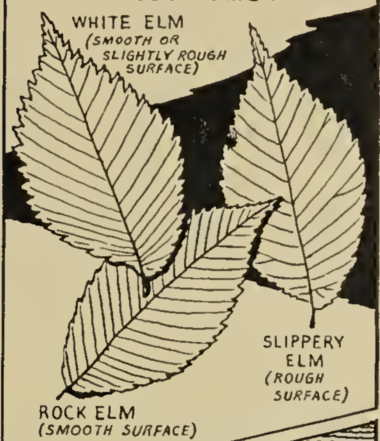
D. FARWELL

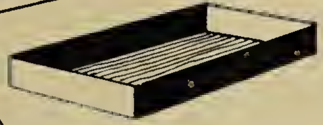
HAVE YOU EVER NOTICED THAT PINE TREES GROWING IN EXPOSED POSITIONS WILL OFTEN SHOW THE DIRECTION OF THE PREVAILING WINDS?

PURSLANE, A GARDEN WEED WITH FLESHY LEAVES AND STEM, GROWS ALONG THE GROUND. THE BEST METHOD OF CONTROL IS BY CAREFUL AND FREQUENT HOEING. SEEDS ARE PRODUCED UNTIL THE TIME OF FROST.

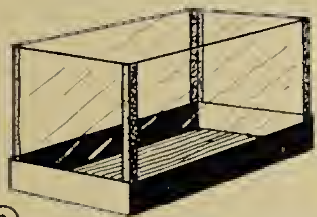


HOW MANY KINDS OF LEAVES CAN YOU RECOGNIZE? DO YOU KNOW THESE ELMS?

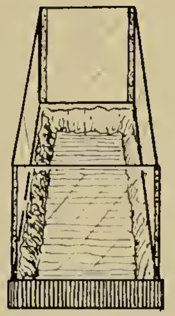

WHITE ELM (SMOOTH OR SLIGHTLY ROUGH SURFACE)
SLIPPERY ELM (ROUGH SURFACE)
ROCK ELM (SMOOTH SURFACE)



① MAKE A TRAY OF GALVANIZED METAL, ABOUT 2" DEEP.

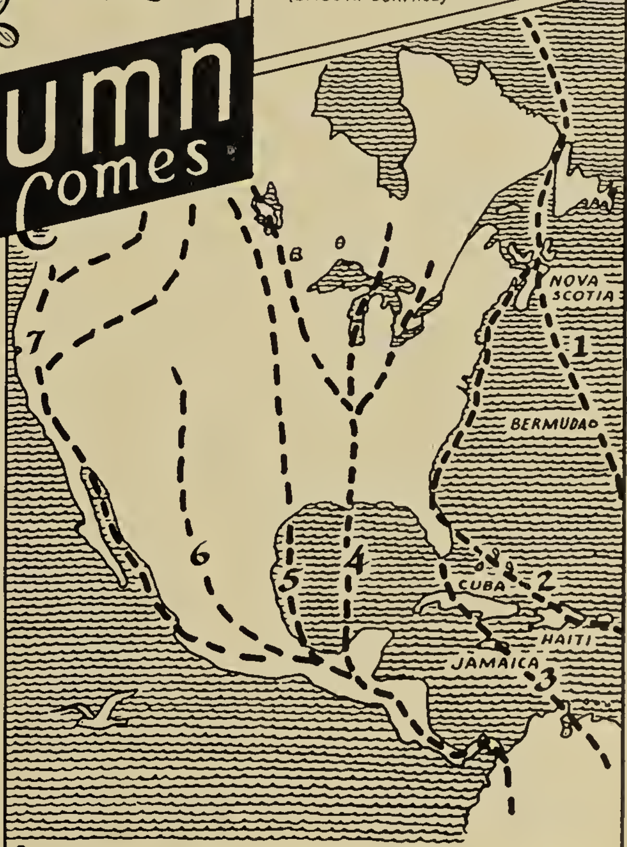


② PUT IN PIECES OF GLASS, TO FIT. FASTEN CORNERS WITH ADHESIVE TAPE.



③ PLASTER OF PARIS AROUND BOTTOM OF GLASS WILL HOLD IT IN PLACE. TERRARIUM IS NOW READY FOR WATER TRAY, EARTH, PLANTS, AND ANIMALS.

A TERRARIUM IS SO EASY TO MAKE THAT NO CLASSROOM SHOULD BE WITHOUT ONE. YOUR TURTLES, TOADS, FROGS, AND SALAMANDERS SHOULD PASS THE WINTER SUCCESSFULLY IN SUCH A HOME AS THIS.



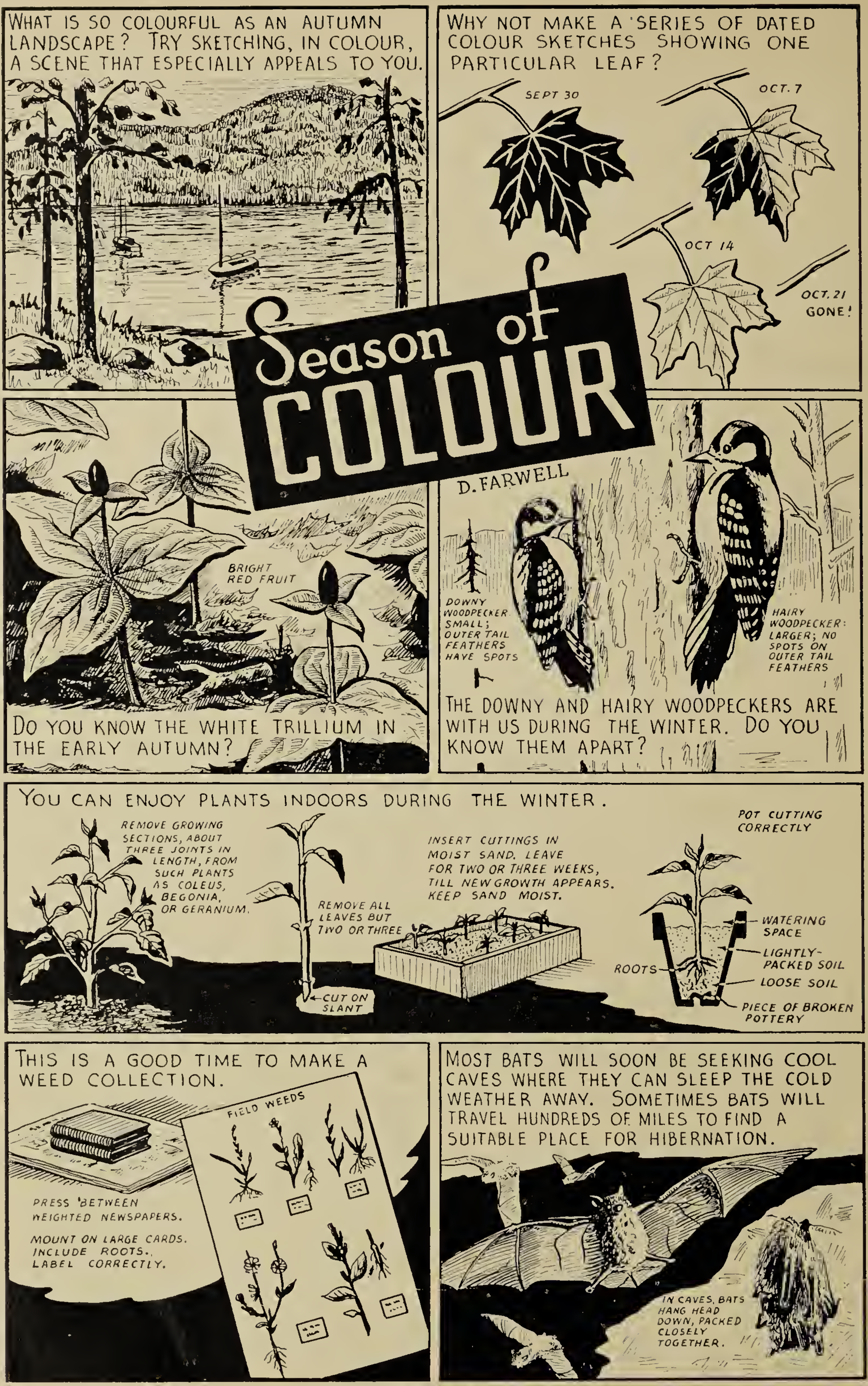
BIRDS GOING SOUTH FOR THE WINTER USUALLY FOLLOW ONE OF THESE SEVEN ROUTES.

"SHOOTING STARS", OR METEORS, ARE SMALL PARTICLES OF MATTER FROM SPACE. DUE TO FRICTION WITH THE ATMOSPHERE, THEY HEAT UP, GLOW, AND BURN OUT. THE OCCASIONAL BIG ONES THAT REACH THE EARTH ARE KNOWN AS METEORITES.

SOME FINE AUTUMN DAY VISIT A BEECH WOODS. FIND A COMFORTABLE SPOT WHERE YOU CAN SIT AS STILL AS POSSIBLE. SOON YOU WILL SEE THE SQUIRRELS AT WORK, PREPARING FOR WINTER BY GATHERING BEECH NUTS.

Season of COLOUR

D. FARWELL



WHAT IS SO COLOURFUL AS AN AUTUMN LANDSCAPE? TRY SKETCHING, IN COLOUR, A SCENE THAT ESPECIALLY APPEALS TO YOU.

WHY NOT MAKE A SERIES OF DATED COLOUR SKETCHES SHOWING ONE PARTICULAR LEAF?

SEPT 30
OCT. 7
OCT 14
OCT. 21 GONE!

DO YOU KNOW THE WHITE TRILLIUM IN THE EARLY AUTUMN?

BRIGHT RED FRUIT

THE DOWNY AND HAIRY WOODPECKERS ARE WITH US DURING THE WINTER. DO YOU KNOW THEM APART?

DOWNY WOODPECKER SMALL; OUTER TAIL FEATHERS HAVE SPOTS
HAIRY WOODPECKER: LARGER; NO SPOTS ON OUTER TAIL FEATHERS

YOU CAN ENJOY PLANTS INDOORS DURING THE WINTER.

REMOVE GROWING SECTIONS, ABOUT THREE JOINTS IN LENGTH, FROM SUCH PLANTS AS COLEUS, BEGONIA, OR GERANIUM.
REMOVE ALL LEAVES BUT TWO OR THREE
CUT ON SLANT
INSERT CUTTINGS IN MOIST SAND. LEAVE FOR TWO OR THREE WEEKS, TILL NEW GROWTH APPEARS. KEEP SAND MOIST.
POT CUTTING CORRECTLY
WATERING SPACE
LIGHTLY-PACKED SOIL
LOOSE SOIL
ROOTS
PIECE OF BROKEN POTTERY

THIS IS A GOOD TIME TO MAKE A WEED COLLECTION.

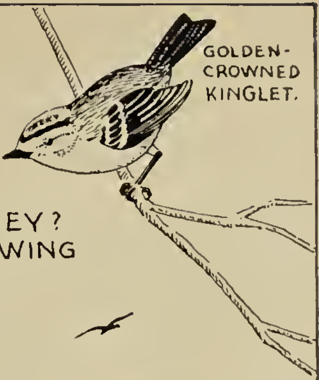
FIELD WEEDS
PRESS BETWEEN WEIGHTED NEWSPAPERS.
MOUNT ON LARGE CARDS. INCLUDE ROOTS. LABEL CORRECTLY.

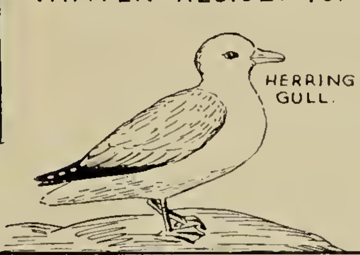
MOST BATS WILL SOON BE SEEKING COOL CAVES WHERE THEY CAN SLEEP THE COLD WEATHER AWAY. SOMETIMES BATS WILL TRAVEL HUNDREDS OF MILES TO FIND A SUITABLE PLACE FOR HIBERNATION.

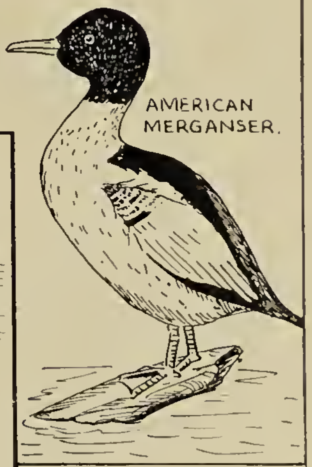
WINTER IS COMING

AMONG THE **BIRDS**, "WINTER RESIDENTS" ARE ARRIVING. WHAT ARE THEY?

MAKE A MURAL DRAWING SHOWING SOME OF OUR "WINTER RESIDENTS."

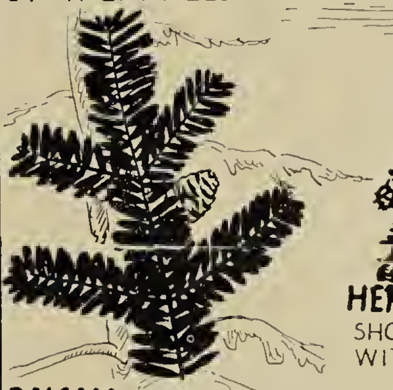

GOLDEN-CROWNED KINGLET.

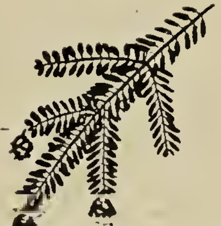

HERRING GULL.


AMERICAN MERGANSER.

CATCH SOME EARLY **SNOWFLAKES** ON YOUR SLEEVE. CAN YOU FIND TWO EXACTLY ALIKE? HOW MANY POINTS HAS EACH FLAKE?

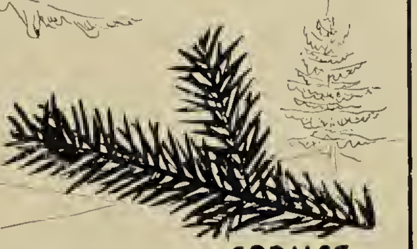
CAN YOU RECOGNIZE THESE **EVERGREENS** BY THEIR NEEDLES?





HEMLOCK NEEDLES ARE SHORT, FLAT, EACH WITH A TINY STALK.

BALSAM NEEDLES ARE LONGER, FLAT, AND HAVE NO STALKS OF THEIR OWN.



YOU CAN ROLL **SPRUCE** NEEDLES BETWEEN YOUR THUMB AND FINGER.

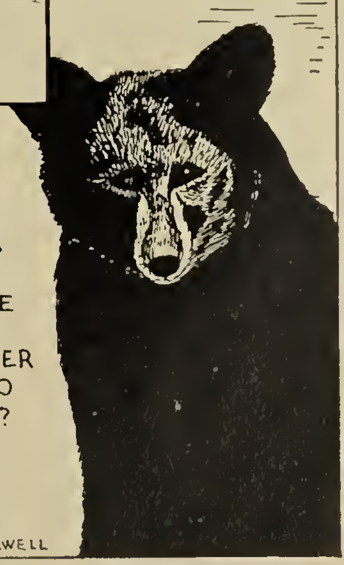
WHY DO EVERGREENS NOT SHED THEIR LEAVES IN WINTER?

THE PUPA OF THE **TOMATO WORM** (SPHINX MOTH), PASSES THE WINTER IN THE SOIL.

AN ATTRACTIVE "EVERLASTING" BOUQUET CAN BE MADE FROM **TEASELS** AND **CHINESE LANTERNS** TRY IT!

FISH MOVE ABOUT UNDER THE ICE ALL WINTER.

WHAT FOOD CAN THEY FIND?



THE **BEAR** SLEEPS DURING THE WINTER.

WHAT OTHER ANIMALS DO THE SAME?

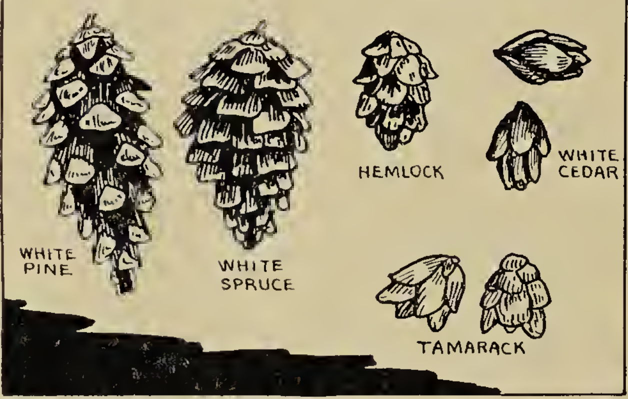
NATURE ACTIVITIES WEEK BY WEEK

NOVEMBER

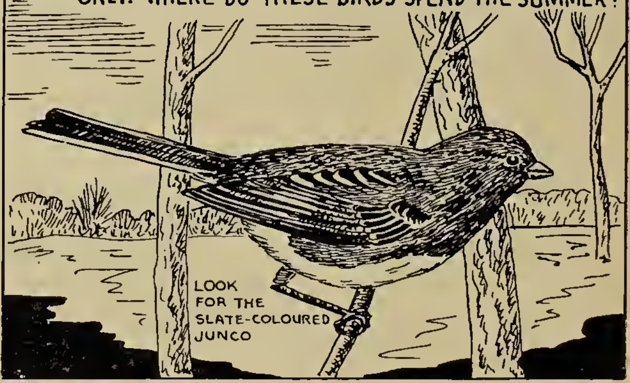
① THIS WEEK MAKE IT A POINT TO SEARCH IN THE WOODS FOR THE WINTERGREEN WITH ITS RED BERRIES. WHY IS THIS PLANT SO CALLED? CRUSH A LEAF AND SMELL IT.

② LOOK FOR DEAD TEASELS IN THE FIELDS. EXAMINE THEM CLOSELY. CAN YOU SUGGEST WHY THEY ARE USED IN WOOLLEN MILLS FOR RAISING THE NAP ON BLANKETS?

③ HOW MANY DIFFERENT KINDS OF OLD EVERGREEN CONES CAN YOU FIND?



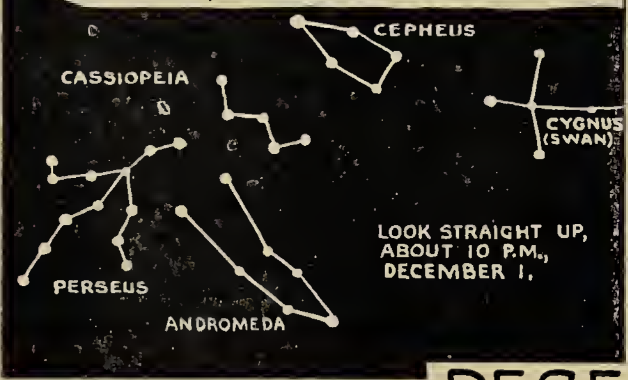
④ "WINTER RESIDENTS" AMONG THE BIRDS ARE THOSE THAT STAY WITH US DURING THE COLDER WEATHER ONLY. WHERE DO THESE BIRDS SPEND THE SUMMER?



LOOK FOR THE SLATE-COLOURED JUNCO

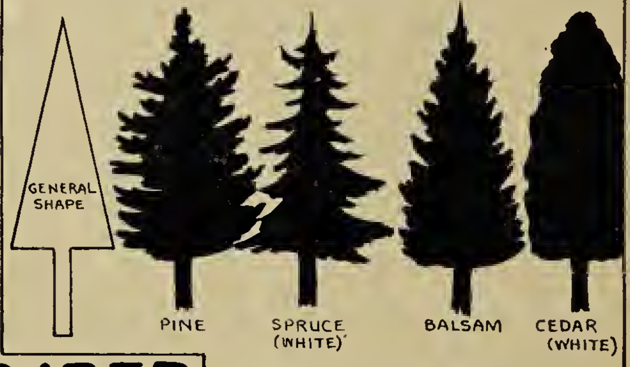
DECEMBER

① NOW YOU CAN MAKE A STAR MAP SHOWING THE COMPLETE ROYAL FAMILY IN THE SKY—CEPHEUS, THE KING; CASSIOPEIA, THE QUEEN; PERSEUS, THE PRINCE; AND ANDROMEDA, THE DAUGHTER. FIND THEM ALL.



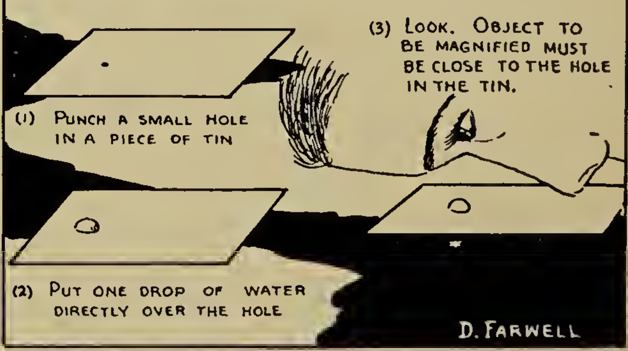
LOOK STRAIGHT UP, ABOUT 10 P.M., DECEMBER 1.

② WHY NOT GO SKETCHING EVERGREEN TREES THIS WEEK? WHAT GENERAL SHAPE IS COMMON TO ALL EVERGREENS? NOTICE ALSO HOW EACH KIND HAS A PARTICULAR SHAPE OF ITS OWN.



③ GATHER HOLLY FOR CHRISTMAS, BRITISH COLUMBIANS! WHY DOES HOLLY GROW ONLY IN THE MILDER PARTS OF BRITISH COLUMBIA?

④ MAKE THIS SIMPLE MICROSCOPE. LOOK AT SNOWFLAKES THROUGH IT. BE CAREFUL NOT TO MELT THE SNOWFLAKE WITH YOUR BREATH BEFORE YOU GET A GOOD LOOK!



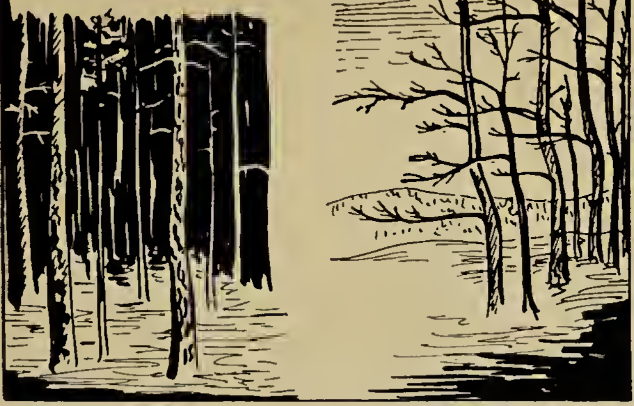
(1) PUNCH A SMALL HOLE IN A PIECE OF TIN

(2) PUT ONE DROP OF WATER DIRECTLY OVER THE HOLE

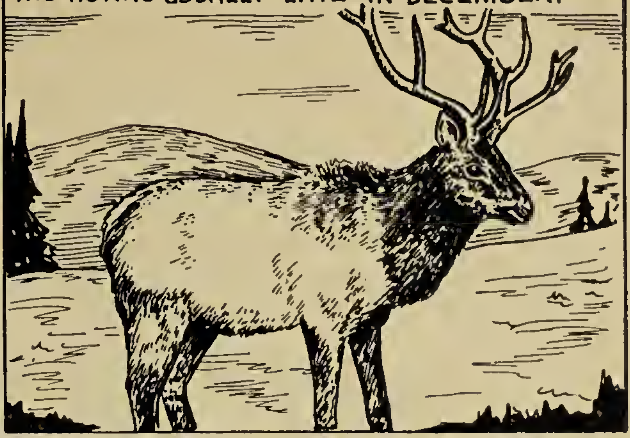
(3) LOOK. OBJECT TO BE MAGNIFIED MUST BE CLOSE TO THE HOLE IN THE TIN.

D. FARWELL

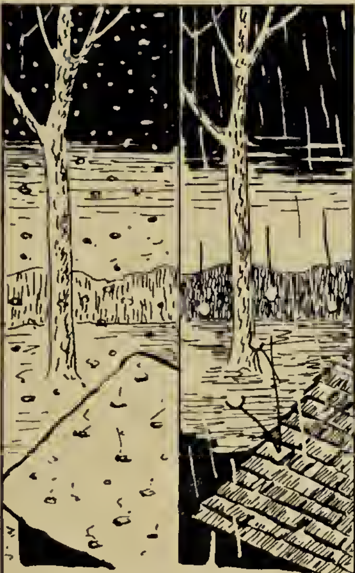
TREES "REACH FOR THE LIGHT." COMPARE THE SHAPES OF TREES ON THE EDGE OF A WOODS WITH THOSE INSIDE.



THE FULL-GROWN STAG WAPITI, OR ELK, SHEDS HIS HORNS USUALLY LATE IN DECEMBER.



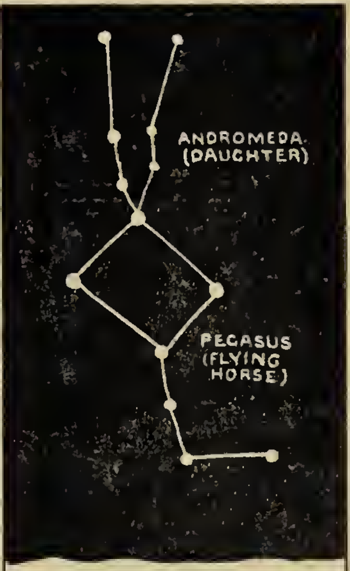
COLDER WEATHER



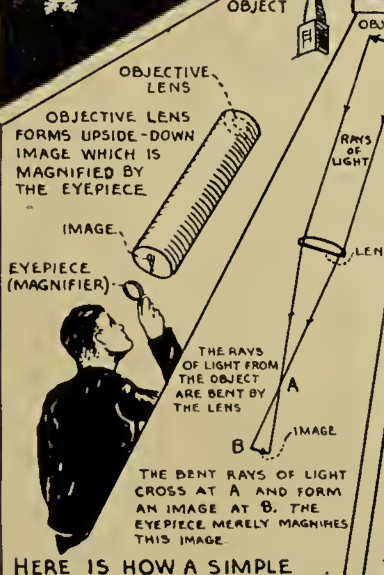
SNOW IS MADE UP OF TINY PARTICLES OF MOISTURE FORMED INTO CRYSTALS HIGH UP IN THE AIR.

HAIL IS FROZEN RAIN.

THE RACCOON PUTS ON ENOUGH FAT IN FALL TO LAST IT THROUGH THE WINTER. USUALLY SEVERAL CURL UP TOGETHER IN THE SAME NEST FOR THEIR WINTER SLEEP.

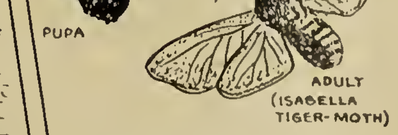


HERE ARE TWO GROUPS OF STARS YOU CAN LEARN TO RECOGNIZE EASILY. THEY EXTEND FROM STRAIGHT ABOVE YOU TO NEAR THE SOUTH-WESTERN HORIZON AT ABOUT NINE O'CLOCK, DECEMBER 15.


OBJECT
OBJECTIVE LENS
OBJECTIVE LENS FORMS UPSIDE-DOWN IMAGE WHICH IS MAGNIFIED BY THE EYEPIECE
IMAGE
EYEPIECE (MAGNIFIER)
OBJECT
RAYS OF LIGHT
LENS
THE RAYS OF LIGHT FROM THE OBJECT ARE BENT BY THE LENS
A
B
IMAGE
THE BENT RAYS OF LIGHT CROSS AT A AND FORM AN IMAGE AT B. THE EYEPIECE MERELY MAGNIFIES THIS IMAGE

HERE IS HOW A SIMPLE TELESCOPE WORKS. WHY DO YOU SEE THE IMAGE UPSIDE DOWN?

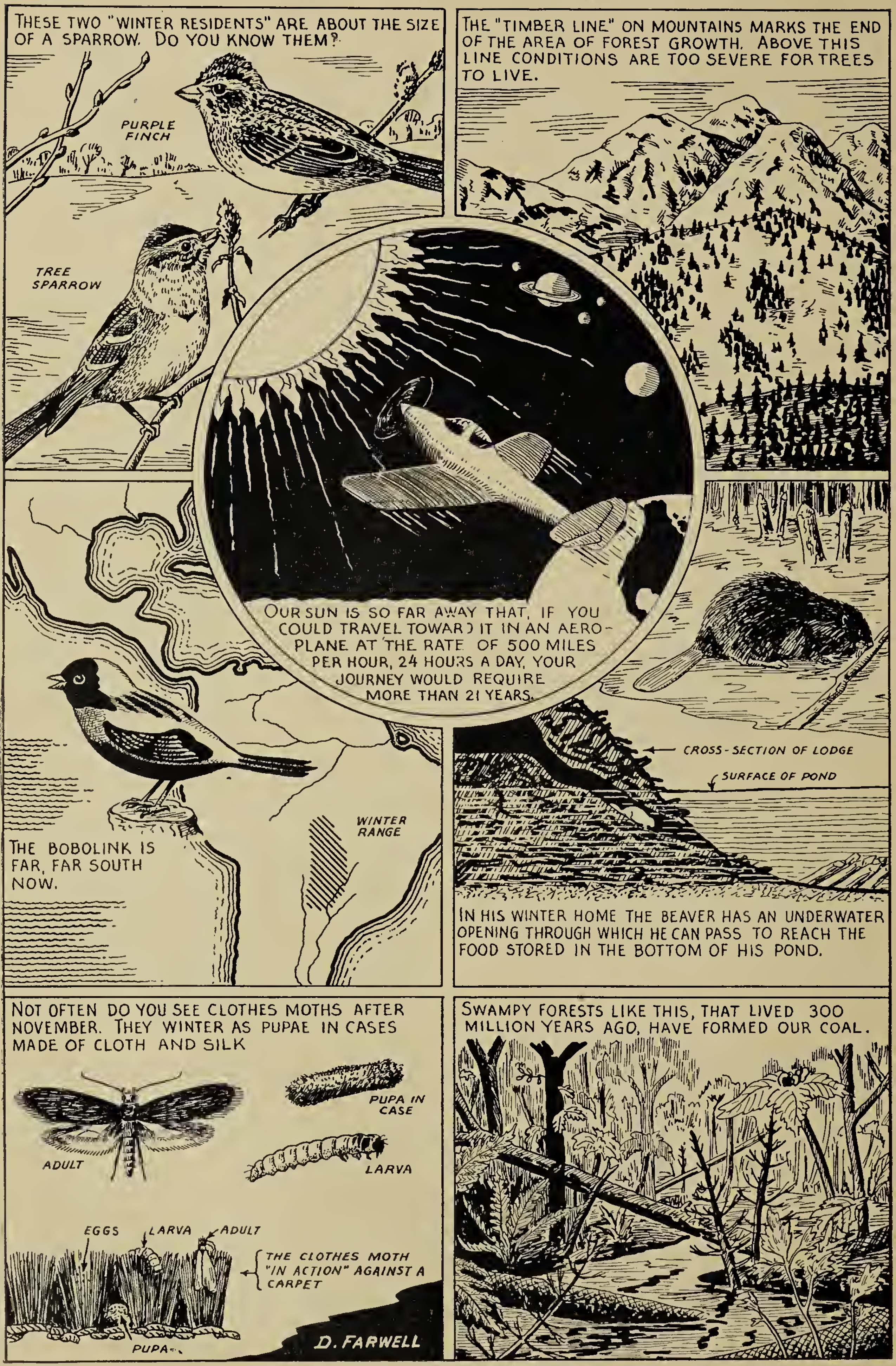
THE BROWN CREEPER VISITS US DURING THE WINTER. WITH ITS LONG, SLENDER, CURVED BILL IT REMOVES INSECTS FROM UNDER THE BARK. HOW IS ITS METHOD OF FEEDING DIFFERENT FROM THAT OF THE WOODPECKER?



USUALLY THE "WOOLLY BEAR" DOES NOT MAKE ITS COCOON TILL SPRING — IT FINDS SOME SHELTERED SPOT AND CURLS UP FOR A LONG WINTER NAP.

D. FARWELL

"If Winter Comes...."



THESE TWO "WINTER RESIDENTS" ARE ABOUT THE SIZE OF A SPARROW. DO YOU KNOW THEM?

THE "TIMBER LINE" ON MOUNTAINS MARKS THE END OF THE AREA OF FOREST GROWTH. ABOVE THIS LINE CONDITIONS ARE TOO SEVERE FOR TREES TO LIVE.

OUR SUN IS SO FAR AWAY THAT, IF YOU COULD TRAVEL TOWARD IT IN AN AEROPLANE AT THE RATE OF 500 MILES PER HOUR, 24 HOURS A DAY, YOUR JOURNEY WOULD REQUIRE MORE THAN 21 YEARS.

THE BOBOLINK IS FAR, FAR SOUTH NOW.

IN HIS WINTER HOME THE BEAVER HAS AN UNDERWATER OPENING THROUGH WHICH HE CAN PASS TO REACH THE FOOD STORED IN THE BOTTOM OF HIS POND.

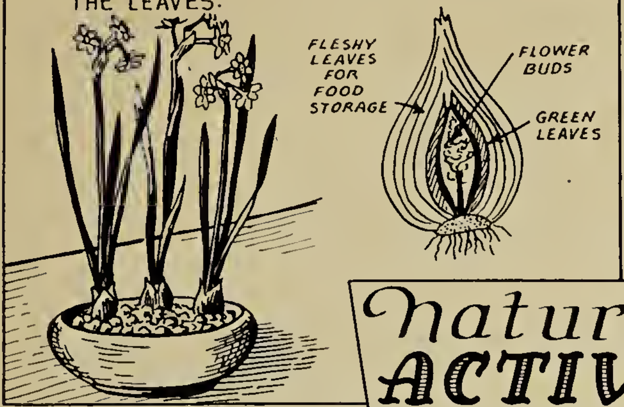
NOT OFTEN DO YOU SEE CLOTHES MOTHS AFTER NOVEMBER. THEY WINTER AS PUPAE IN CASES MADE OF CLOTH AND SILK

SWAMPY FORESTS LIKE THIS, THAT LIVED 300 MILLION YEARS AGO, HAVE FORMED OUR COAL.

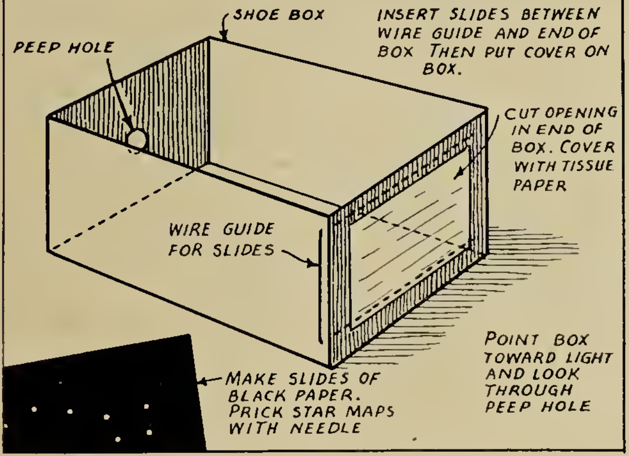
Nature ACTIVITIES WEEK by WEEK

NOVEMBER

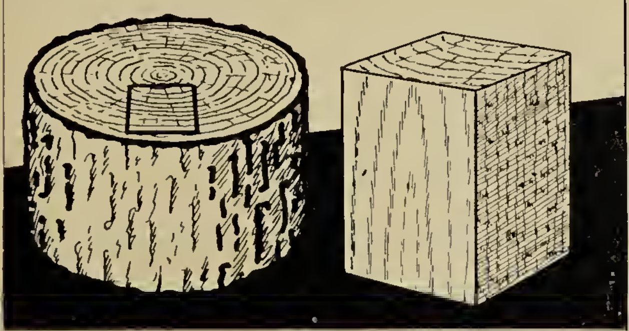
① Did you ever wonder why a narcissus bulb blooms? Cut one in half; find the tiny "flower" snugly tucked away inside the leaves.


FLESHY LEAVES FOR FOOD STORAGE
FLOWER BUDS
GREEN LEAVES

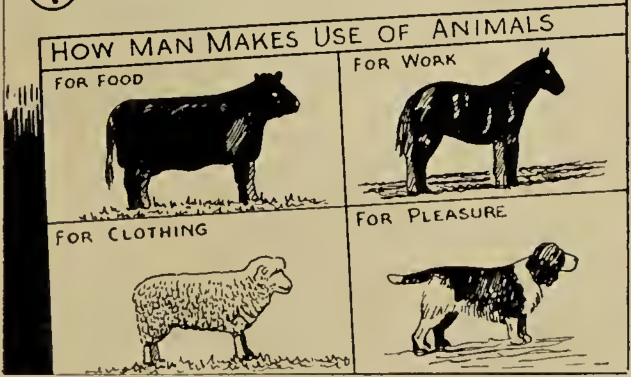
② You can learn many star groups with this simple "constellation box."


SHOE BOX
PEEP HOLE
INSERT SLIDES BETWEEN WIRE GUIDE AND END OF BOX. THEN PUT COVER ON BOX.
CUT OPENING IN END OF BOX. COVER WITH TISSUE PAPER
WIRE GUIDE FOR SLIDES
MAKE SLIDES OF BLACK PAPER. PRICK STAR MAPS WITH NEEDLE
POINT BOX TOWARD LIGHT AND LOOK THROUGH PEEP HOLE

③ From a section of firewood cut a rectangular piece as shown. Notice the different appearance of the grain on each surface.



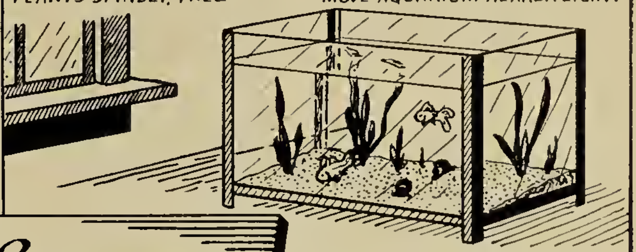
④ Here's an interesting chart to make. Use cut-out pictures or make drawings.



DECEMBER

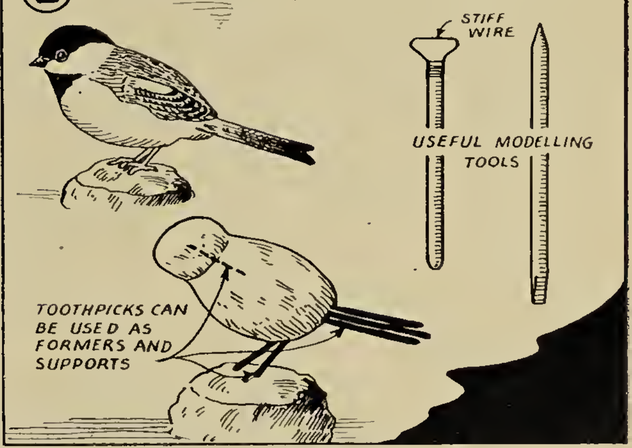
① This week check your aquarium for balance of animal life, plants, and light:

FAULT	CORRECTION
GREEN GROWTH ON GLASS	MOVE AQUARIUM FARTHER FROM WINDOW; ADD SNAILS.
FISH AT SURFACE, GASPING	ADD MORE PLANTS.
PLANTS SPINDLY, PALE	MOVE AQUARIUM NEARER LIGHT.

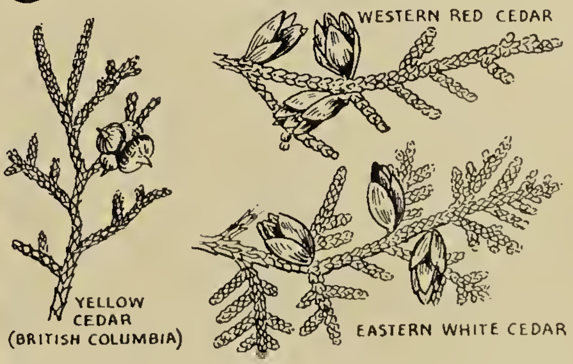


You do not need to change the water of a balanced aquarium.

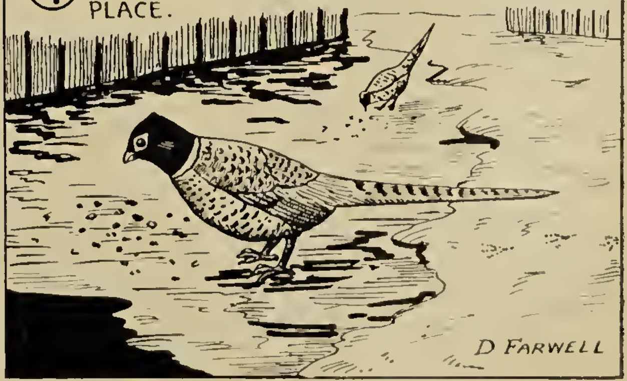
② It's fun to model winter birds. Use plasticene or clay. Colour with poster paint.


STIFF WIRE
USEFUL MODELLING TOOLS
TOOTHPICKS CAN BE USED AS FORMERS AND SUPPORTS

③ Do you know these cedar trees? Which ones grow near your community?



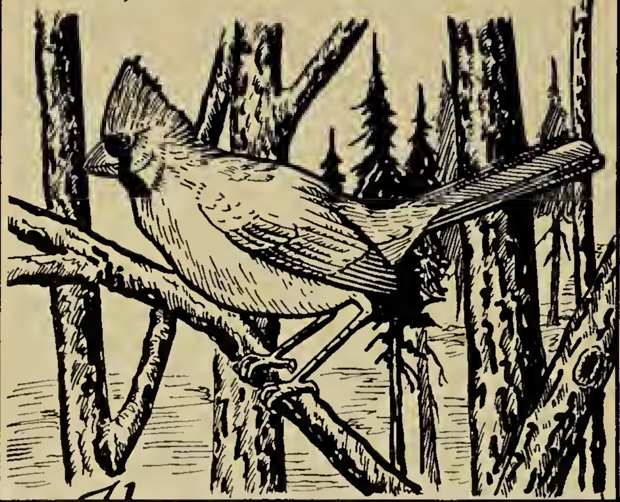
④ You can coax pheasants around by spreading food for them in a sheltered place.



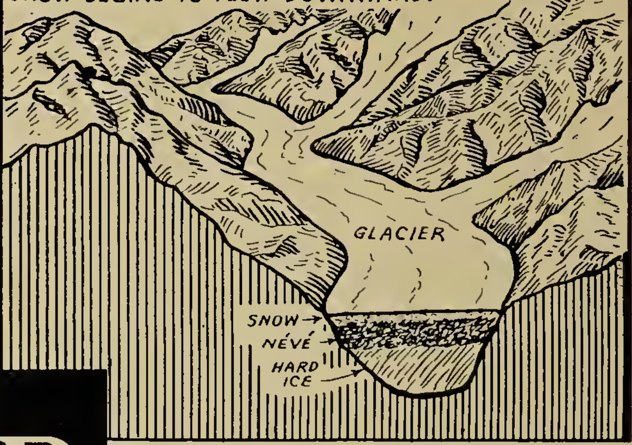
The Beginning *of* WINTER

D. FARWELL

IF YOU SEE, IN THE WOODS, A RED BIRD WITH A CREST, THAT WILL BE THE CARDINAL.



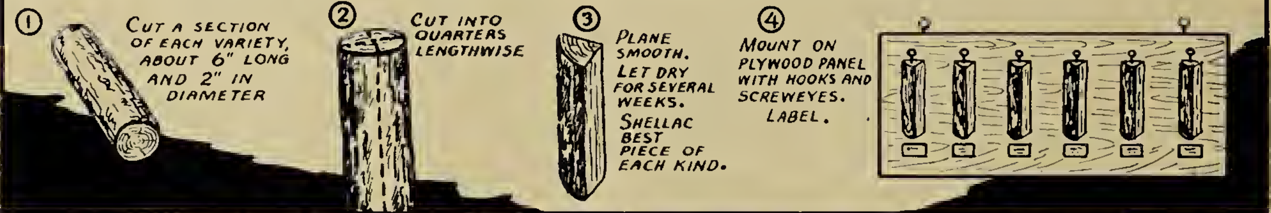
GLACIERS FORM IN PLACES WHERE SNOWFALLS ARE NOT MELTED IN SUMMER. THE WEIGHT OF THE PILING-UP SNOW GRADUALLY TURNS THE UNDERNEATH PART INTO LITTLE PARTICLES OF ICE, KNOWN AS NÉVÉ, AND THE NÉVÉ, IN TURN, INTO HARD ICE. EVENTUALLY THE THICK PILE OF ICE, NÉVÉ, AND SNOW BEGINS TO FLOW DOWNWARD.



FIND AND FOLLOW THE TRACKS OF A RABBIT OR OTHER ANIMAL IN THE SNOW. BACK IN SCHOOL, IMAGINE YOURSELF AS THE ANIMAL AND WRITE WHAT YOU BELIEVE TO BE THE TRUE STORY OF HIS TRIP.

SEARCH FOR COCOONS UNDER THE BARK OF TREES. CAREFULLY LIFT OFF COCOONS AND BARK TOGETHER, AND KEEP THEM IN A BOX ON THE OUTSIDE WINDOW-SILL UNTIL SPRING. THEN BRING THEM INTO THE WARM ROOM AND BE READY FOR SOME PLEASANT SURPRISES!

MAKE A COLLECTION OF THE DIFFERENT KINDS OF WOOD THAT GROW IN YOUR COMMUNITY.

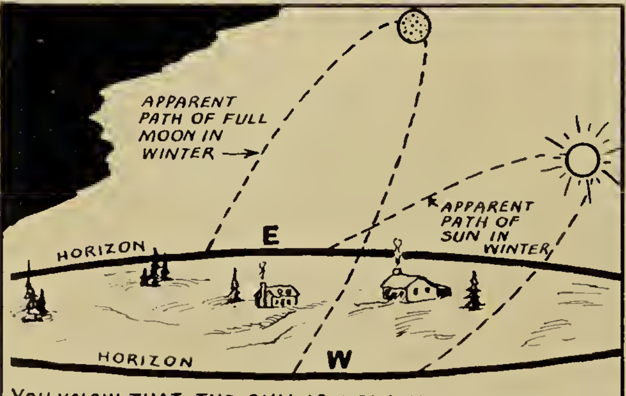


① CUT A SECTION OF EACH VARIETY, ABOUT 6" LONG AND 2" IN DIAMETER

② CUT INTO QUARTERS LENGTHWISE

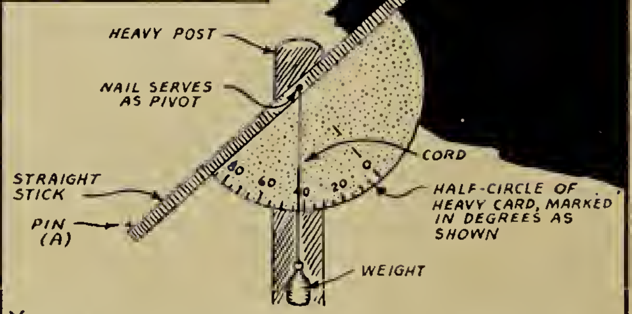
③ PLANE SMOOTH. LET DRY FOR SEVERAL WEEKS. SHELLAC BEST PIECE OF EACH KIND.

④ MOUNT ON PLYWOOD PANEL WITH HOOKS AND SCREWEYES. LABEL.

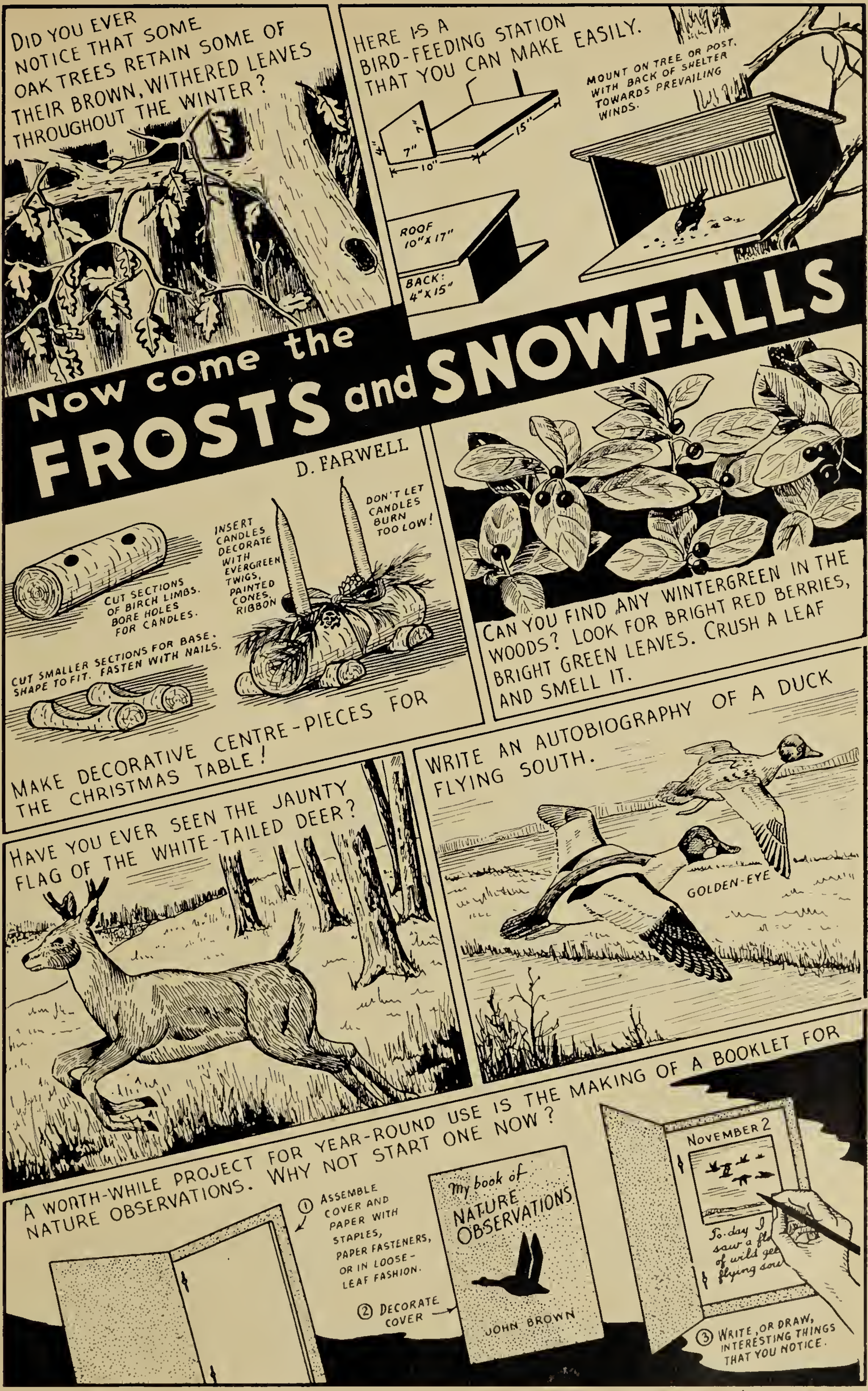

APPARENT PATH OF FULL MOON IN WINTER
APPARENT PATH OF SUN IN WINTER
HORIZON
E
HORIZON
W

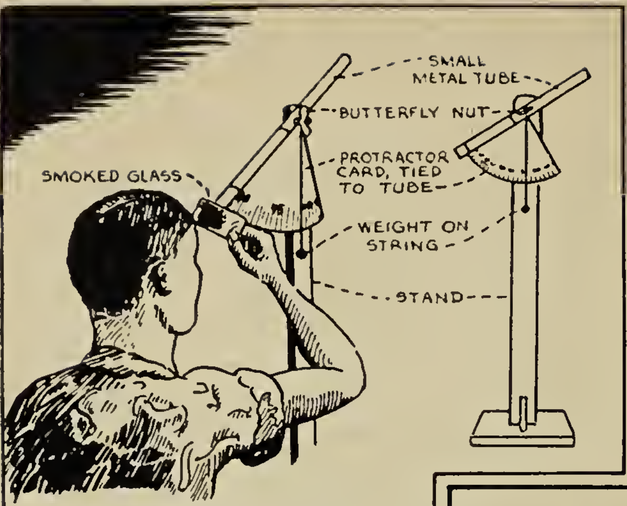
YOU KNOW THAT THE SUN IS LOW IN THE SKY DURING THE WINTER MONTHS, BUT DID YOU KNOW THAT THE FULL MOON REACHES ITS HIGHEST POINT DURING THE SAME SEASON?

LINE UP A AND B WITH THE NORTH STAR. READ LATITUDE ON SCALE, UNDER WEIGHTED CORD.



YOU HAVE USED THIS LITTLE DEVICE TO FIND THE HEIGHT OF THE SUN IN THE SKY AT NOON. NOW USE IT TO FIND YOUR LATITUDE BY POINTING IT AT THE NORTH STAR.

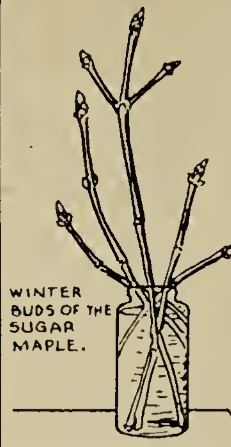

Now come the
FROSTS and SNOWFALLS
D. FARWELL
DID YOU EVER NOTICE THAT SOME OAK TREES RETAIN SOME OF THEIR BROWN, WITHERED LEAVES THROUGHOUT THE WINTER?
HERE IS A BIRD-FEEDING STATION THAT YOU CAN MAKE EASILY.
7"
10"
15"
ROOF 10"X17"
BACK: 4"X15"
MOUNT ON TREE OR POST. WITH BACK OF SHELTER TOWARDS PREVAILING WINDS.
CUT SECTIONS OF BIRCH LIMBS. BORE HOLES FOR CANDLES.
INSERT CANDLES DECORATE WITH EVERGREEN TWIGS, PAINTED CONES, RIBBON
DON'T LET CANDLES BURN TOO LOW!
CUT SMALLER SECTIONS FOR BASE. SHAPE TO FIT. FASTEN WITH NAILS.
MAKE DECORATIVE CENTRE-PIECES FOR THE CHRISTMAS TABLE!
CAN YOU FIND ANY WINTERGREEN IN THE WOODS? LOOK FOR BRIGHT RED BERRIES, BRIGHT GREEN LEAVES. CRUSH A LEAF AND SMELL IT.
HAVE YOU EVER SEEN THE JAUNTY FLAG OF THE WHITE-TAILED DEER?
WRITE AN AUTOBIOGRAPHY OF A DUCK FLYING SOUTH.
GOLDEN-EYE
A WORTH-WHILE PROJECT FOR YEAR-ROUND USE IS THE MAKING OF A BOOKLET FOR NATURE OBSERVATIONS. WHY NOT START ONE NOW?
① ASSEMBLE COVER AND PAPER WITH STAPLES, PAPER FASTENERS, OR IN LOOSE-LEAF FASHION.
② DECORATE COVER
My book of NATURE OBSERVATIONS
JOHN BROWN
November 2
To-day I saw a fl of wild ge flying sou
③ WRITE, OR DRAW, INTERESTING THINGS THAT YOU NOTICE.



WITH THE ABOVE DEVICE, MEASURE THE ANGLE OF THE SUN AT NOON FROM WEEK TO WEEK

WHAT CHANGE ?

MID-WINTER


WINTER BUDS OF THE SUGAR MAPLE.

PUT SOME SMALL BRANCHES OF TREES IN WATER AND LOOK FOR THE EFFECT ON THE BUDS.

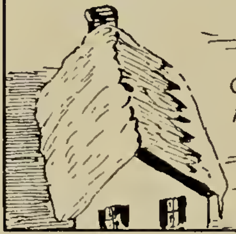
MICE SOMETIMES DESTROY TREES IN WINTER BY GIRDLING THEM.

WHAT OTHER ANIMAL MAY DO THE SAME?

FOR **BIRDS,** AN INVERTED FEEDING TRAY IS EASY TO MAKE. STIR SEEDS, CRUMBS, MEAT SCRAPS, AND A LITTLE SAND IN MELTED SUET. POUR MIXTURE ON A TACK-STUDDED BOARD AND ALLOW TO HARDEN.

THE **CHICKADEE** WILL STAY AROUND YOUR HOME IF YOU FEED HIM.

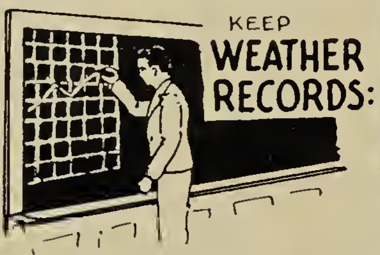
ON WHICH SIDE OF A STREET EXTENDING EAST AND WEST, DOES THE SNOW MELT FIRST ? WHY ?



OF A ROOF FACING NORTH AND SOUTH ? WHY ?

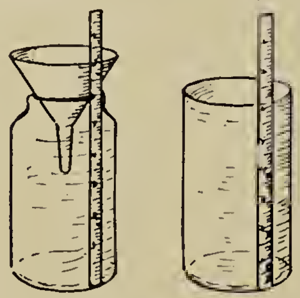
THE **GRAY SQUIRREL** SEARCHES FOR FOOD UNDER THE SNOW —

AND COMES OUT TO ENJOY HIS PINE-CONE DINNER.



KEEP **WEATHER RECORDS:**

TEMPERATURE CHARTS;



RAIN AND SNOW MEASUREMENTS.

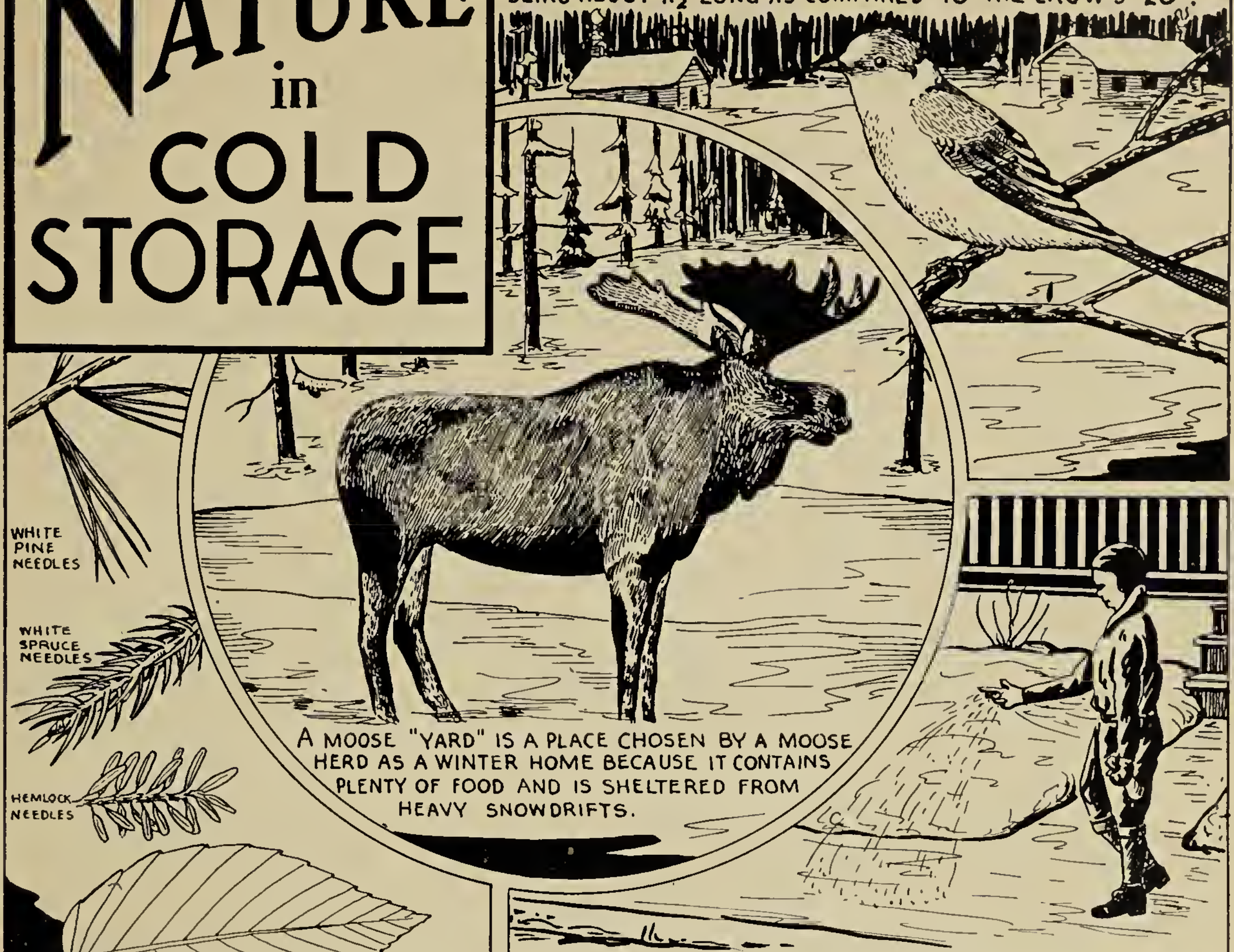
SEARCH FOR THE **COCOONS** OF INSECTS UNDER BARK OR IN SHELTERED PLACES.

HOW MANY KINDS CAN YOU FIND?

FARWELL

NATURE in COLD STORAGE

NORTHERNERS, DO YOU KNOW THAT THE CANADA JAY IS RELATED TO THE CROW? IT IS THE SMALLEST OF THE FAMILY, BEING ABOUT 11½" LONG AS COMPARED TO THE CROW'S 20".

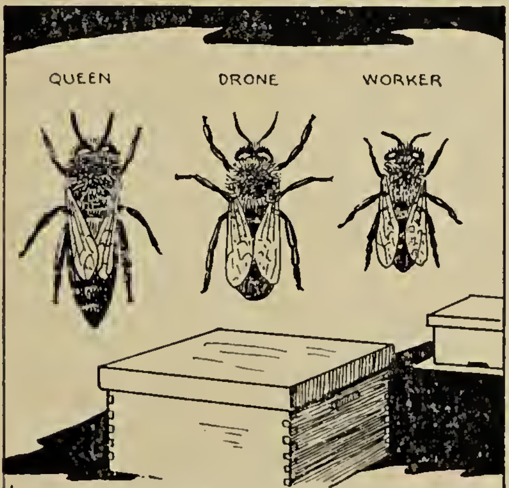


A MOOSE "YARD" IS A PLACE CHOSEN BY A MOOSE HERD AS A WINTER HOME BECAUSE IT CONTAINS PLENTY OF FOOD AND IS SHELTERED FROM HEAVY SNOWDRIFTS.

SALT WATER FREEZES AT A LOWER TEMPERATURE THAN DOES FRESH WATER. WHY, THEN, DOES A SPRINKLING OF SALT SOFTEN THE ICE ON A SIDEWALK?

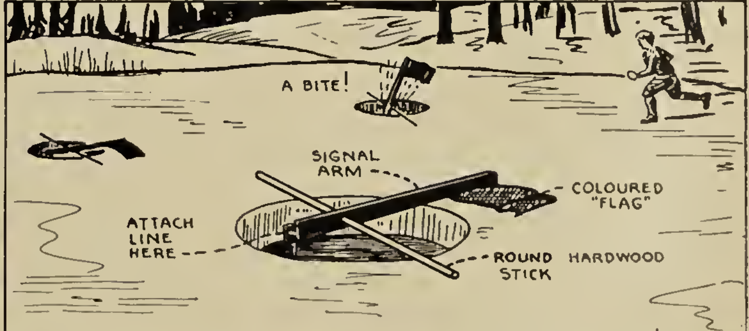
TREES CANNOT GET MOISTURE FROM THE FROZEN GROUND IN WINTER. SINCE LEAVES GIVE OFF MOISTURE, THEY MUST BE SHED TO PREVENT THE TREE FROM DRYING OUT AND DYING.

EVERGREEN NEEDLES STAY ON BECAUSE THEY ARE THICK-SKINNED AND OF SMALL SURFACE, HENCE LOSE BUT LITTLE MOISTURE.



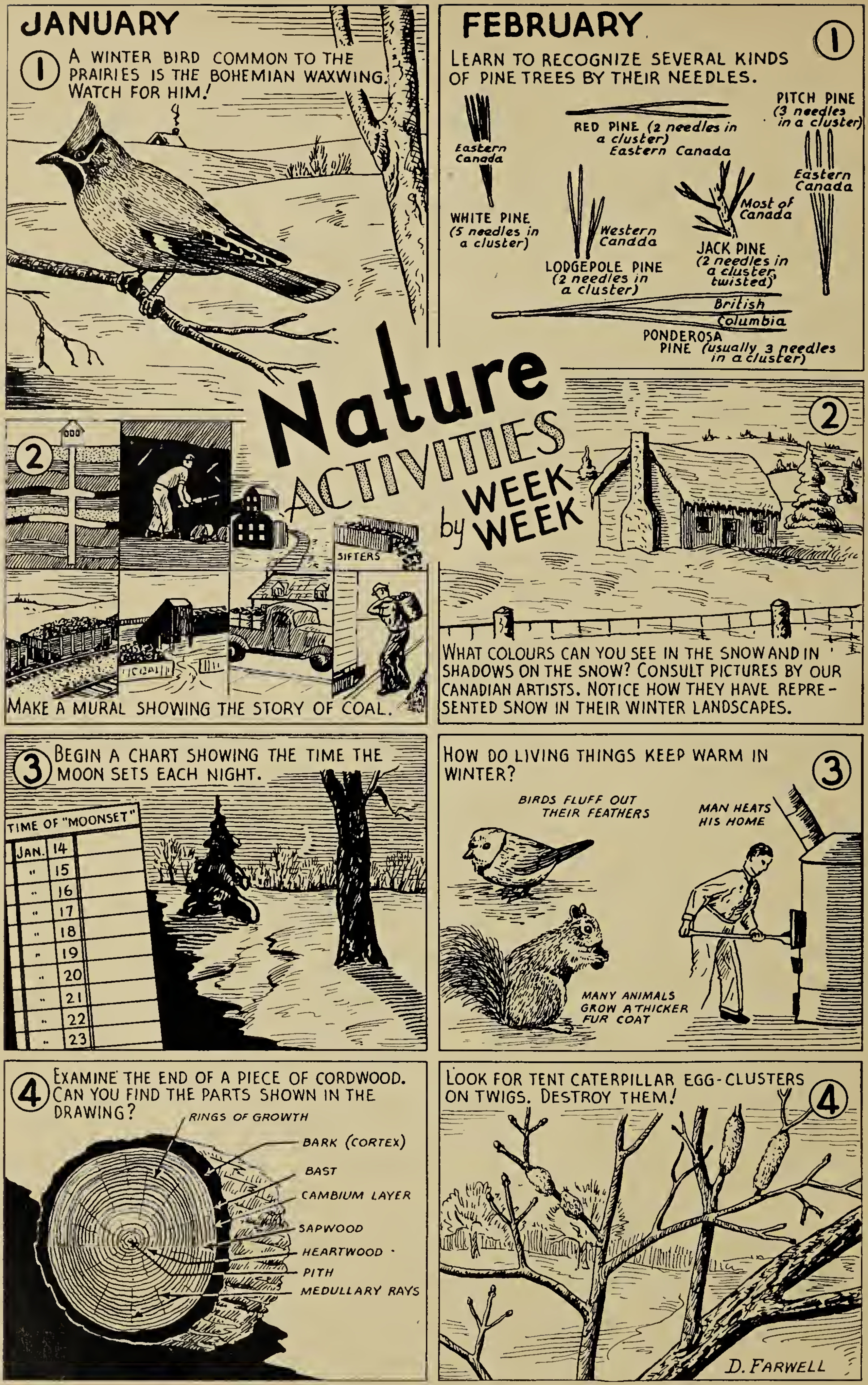
IN WINTER, HONEYBEES FEED ON THE HONEY THEY HAVE MADE DURING THE SUMMER. AN AVERAGE HIVE REQUIRES ABOUT 25 OR 30 POUNDS OF HONEY FOR ITS WINTER'S FOOD.

IN SNOWY REGIONS, ROOFS OF BUILDINGS MUST BE STRONG AND WELL-SLOPED. WHY?



FOR UNUSUAL WINTER SPORT, FISH THROUGH THE ICE! THE SUGGESTED DEVICE WILL TELL YOU WHEN YOU HAVE A BITE! SET SEVERAL LINES.

D. FARWELL


Nature
ACTIVITIES
by WEEK
WEEK
TIME OF "MOONSET"
JAN. 14
" 15
" 16
" 17
" 18
" 19
" 20
" 21
" 22
" 23
SIFTERS
COAL
RINGS OF GROWTH
BARK (CORTEX)
BAST
CAMBIUM LAYER
SAPWOOD
HEARTWOOD
PITH
MEDULLARY RAYS
WHITE PINE (5 needles in a cluster)
Eastern Canada
RED PINE (2 needles in a cluster) Eastern Canada
PITCH PINE (3 needles in a cluster)
Eastern Canada
LODGEPOLE PINE (2 needles in a cluster)
Western Canada
JACK PINE (2 needles in a cluster, twisted)
Most of Canada
PONDEROSA PINE (usually 3 needles in a cluster)
British Columbia
BIRDS FLUFF OUT THEIR FEATHERS
MAN HEATS HIS HOME
MANY ANIMALS GROW A THICKER FUR COAT
D. FARWELL

JANUARY

① A WINTER BIRD COMMON TO THE PRAIRIES IS THE BOHEMIAN WAXWING. WATCH FOR HIM!

② MAKE A MURAL SHOWING THE STORY OF COAL.

③ BEGIN A CHART SHOWING THE TIME THE MOON SETS EACH NIGHT.

④ EXAMINE THE END OF A PIECE OF CORDWOOD. CAN YOU FIND THE PARTS SHOWN IN THE DRAWING?

FEBRUARY

① LEARN TO RECOGNIZE SEVERAL KINDS OF PINE TREES BY THEIR NEEDLES.

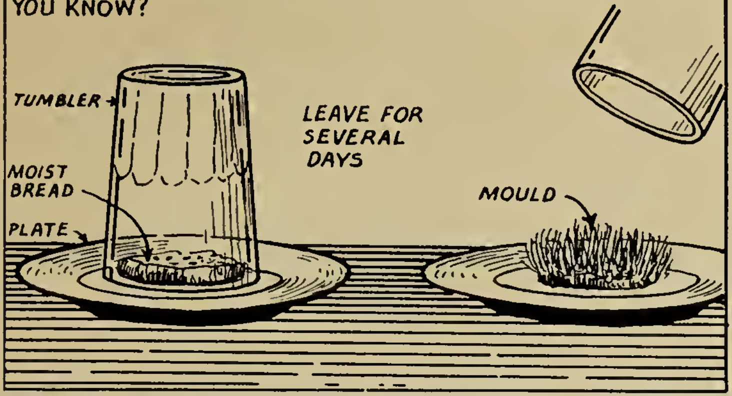
② WHAT COLOURS CAN YOU SEE IN THE SNOW AND IN SHADOWS ON THE SNOW? CONSULT PICTURES BY OUR CANADIAN ARTISTS. NOTICE HOW THEY HAVE REPRESENTED SNOW IN THEIR WINTER LANDSCAPES.

③ HOW DO LIVING THINGS KEEP WARM IN WINTER?

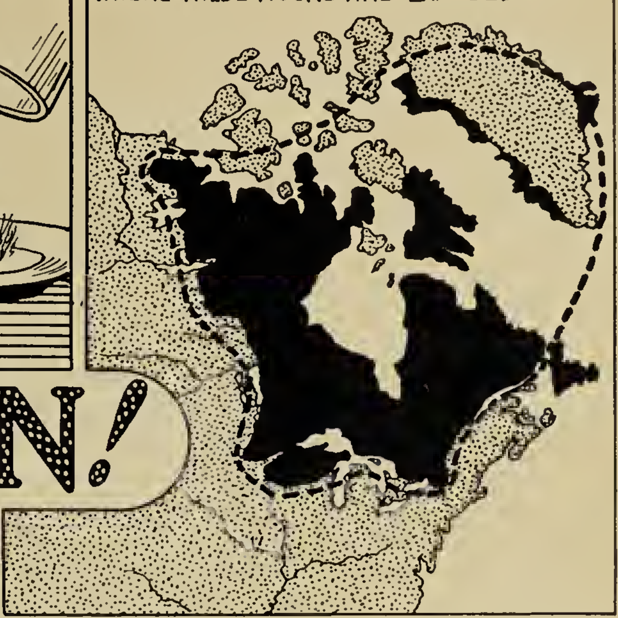
④ LOOK FOR TENT CATERPILLAR EGG-CLUSTERS ON TWIGS. DESTROY THEM!

JANUARY AND FEBRUARY

GROW MOULD ON BREAD AS SHOWN. THIS MOULD IS A FORM OF FUNGUS CALLED A "SAPROPHYTE"; THAT IS, A PLANT THAT LIVES ON DEAD OR DECAYING MATTER. WHAT OTHER EXAMPLES DO YOU KNOW?

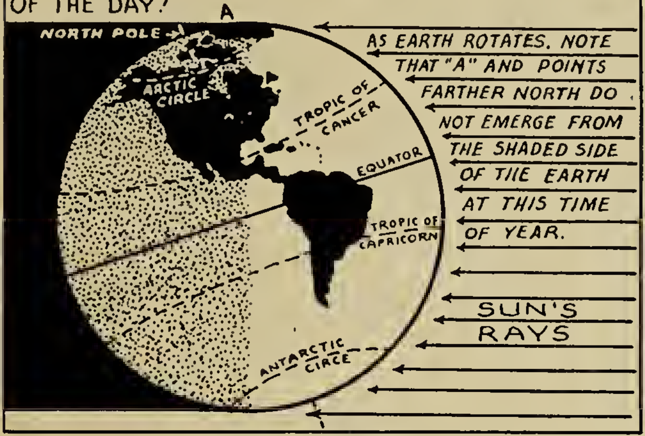


THE OLDEST KNOWN ROCKS ARE "PRECAMBRIAN" ROCKS. THE CANADIAN SHIELD (SEE MAP) IS THE LARGEST SINGLE AREA IN THE WORLD WHERE THESE ROCKS ARE EXPOSED.



SNOWED IN!

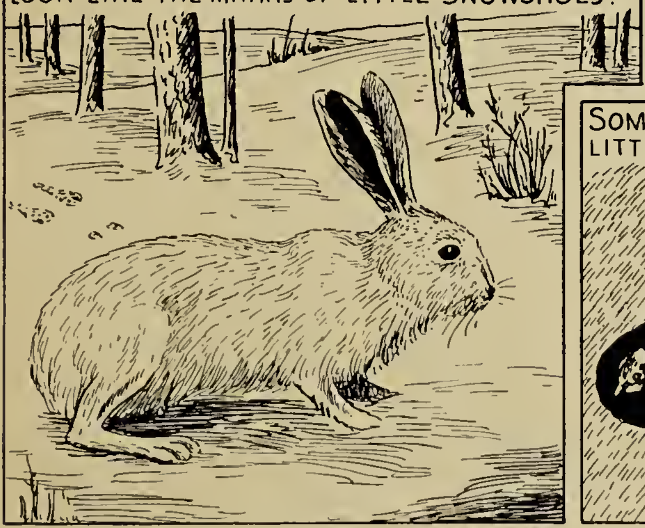
IT IS NIGHT IN THE ARCTIC NOW — ALL 24 HOURS OF THE DAY!



AS EARTH ROTATES, NOTE THAT "A" AND POINTS FARTHER NORTH DO NOT EMERGE FROM THE SHADED SIDE OF THE EARTH AT THIS TIME OF YEAR.

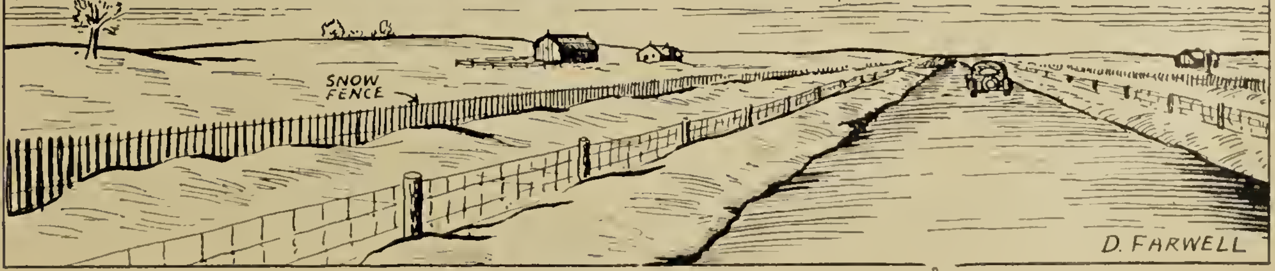
SNOWSHOES KEEP YOU ON TOP OF THE SNOW BECAUSE THEY DISTRIBUTE YOUR WEIGHT OVER A LARGE AMOUNT OF SURFACE.

DID YOU KNOW THAT THE SNOWSHOE HARE IS SO-CALLED BECAUSE HIS TRACKS IN THE SNOW LOOK LIKE THE MARKS OF LITTLE SNOWSHOES?



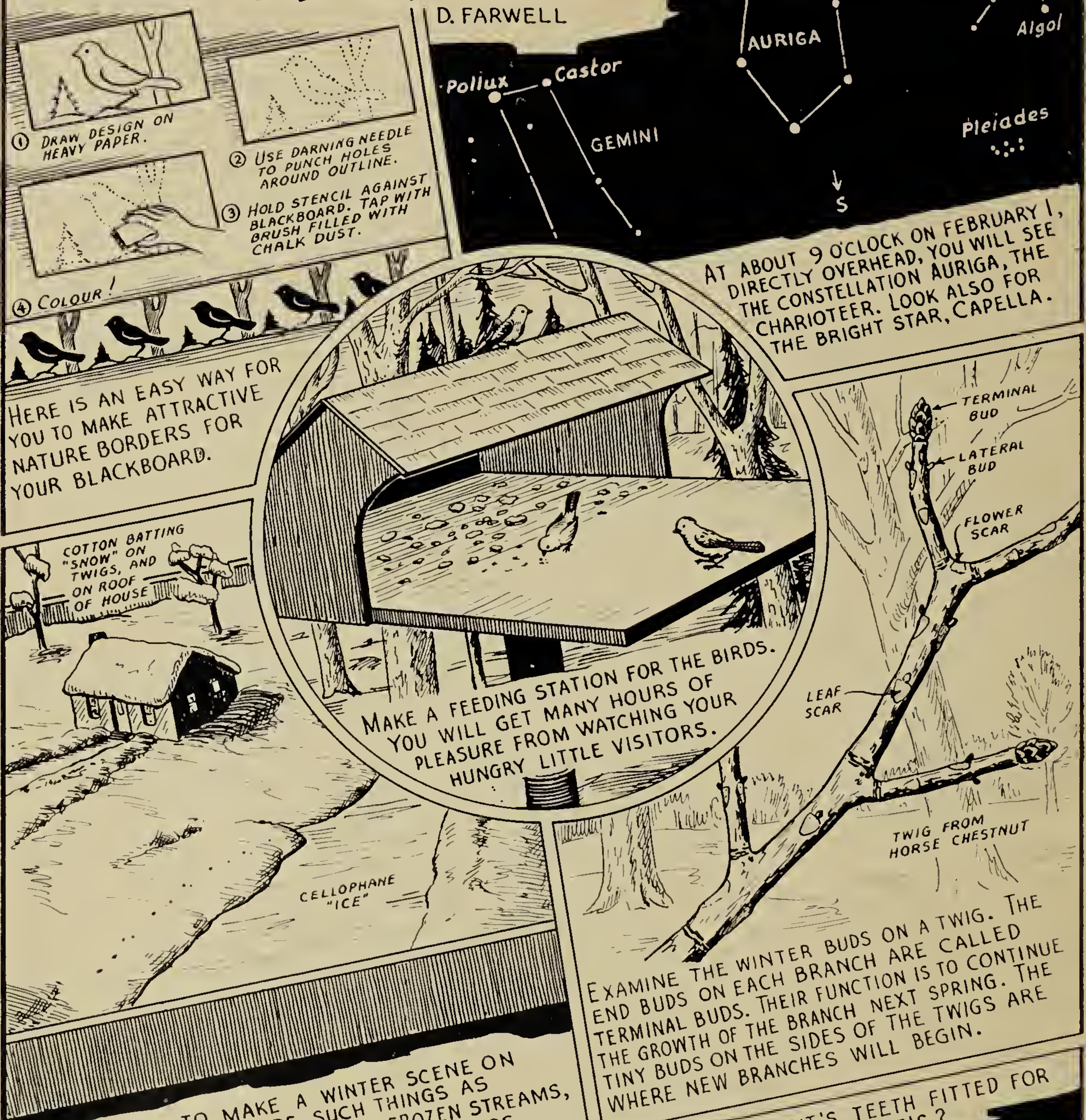
SOMETIMES THE RUFFED GROUSE WILL DIG A COZY LITTLE SLEEPING PLACE INSIDE A SNOWBANK!

SNOW FENCES COLLECT DRIFTING SNOW THAT OTHERWISE MIGHT PILE UP ON THE HIGHWAYS.



MID-WINTER

D. FARWELL



① DRAW DESIGN ON HEAVY PAPER.
② USE DARNING NEEDLE TO PUNCH HOLES AROUND OUTLINE.
③ HOLD STENCIL AGAINST BLACKBOARD. TAP WITH BRUSH FILLED WITH CHALK DUST.
④ COLOUR!
N
Capella
PERSEUS
Algol
AURIGA
Pollux
Castor
GEMINI
Pleiades
S
COTTON BATTING "SNOW" ON TWIGS, AND ON ROOF OF HOUSE
CELLOPHANE "ICE"
TERMINAL BUD
LATERAL BUD
FLOWER SCAR
LEAF SCAR
TWIG FROM HORSE CHESTNUT

HERE IS AN EASY WAY FOR YOU TO MAKE ATTRACTIVE NATURE BORDERS FOR YOUR BLACKBOARD.

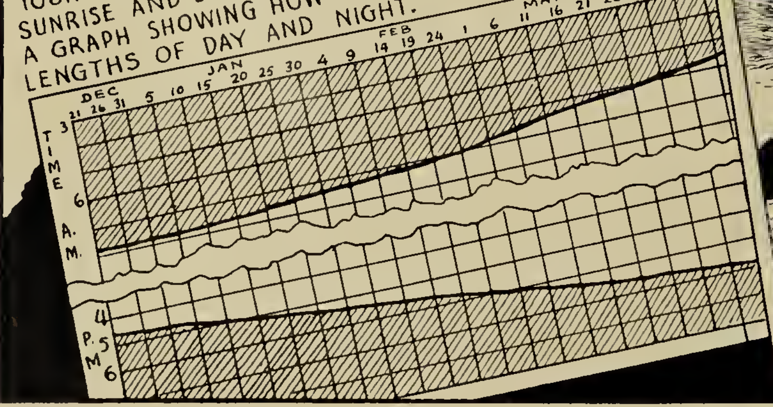
AT ABOUT 9 O'CLOCK ON FEBRUARY 1, DIRECTLY OVERHEAD, YOU WILL SEE THE CONSTELLATION AURIGA, THE CHARIOTEER. LOOK ALSO FOR THE BRIGHT STAR, CAPELLA.

MAKE A FEEDING STATION FOR THE BIRDS. YOU WILL GET MANY HOURS OF PLEASURE FROM WATCHING YOUR HUNGRY LITTLE VISITORS.

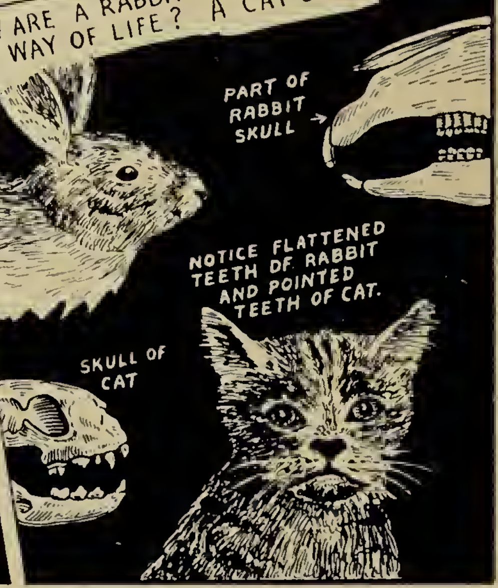
EXAMINE THE WINTER BUDS ON A TWIG. THE END BUDS ON EACH BRANCH ARE CALLED TERMINAL BUDS. THEIR FUNCTION IS TO CONTINUE THE GROWTH OF THE BRANCH NEXT SPRING. THE TINY BUDS ON THE SIDES OF THE TWIGS ARE WHERE NEW BRANCHES WILL BEGIN.

WHAT FUN IT IS TO MAKE A WINTER SCENE ON THE SAND-TABLE! INCLUDE SUCH THINGS AS SNOWDRIFTS, SNOW-LADEN TREES, FROZEN STREAMS, ANIMAL TRACKS, AND SNOW-COVERED BUILDINGS.

YOUR NEWSPAPER WILL GIVE YOU THE TIMES OF SUNRISE AND SUNSET. IT IS WORTH WHILE TO MAKE A GRAPH SHOWING HOW THESE TIMES AFFECT THE LENGTHS OF DAY AND NIGHT.



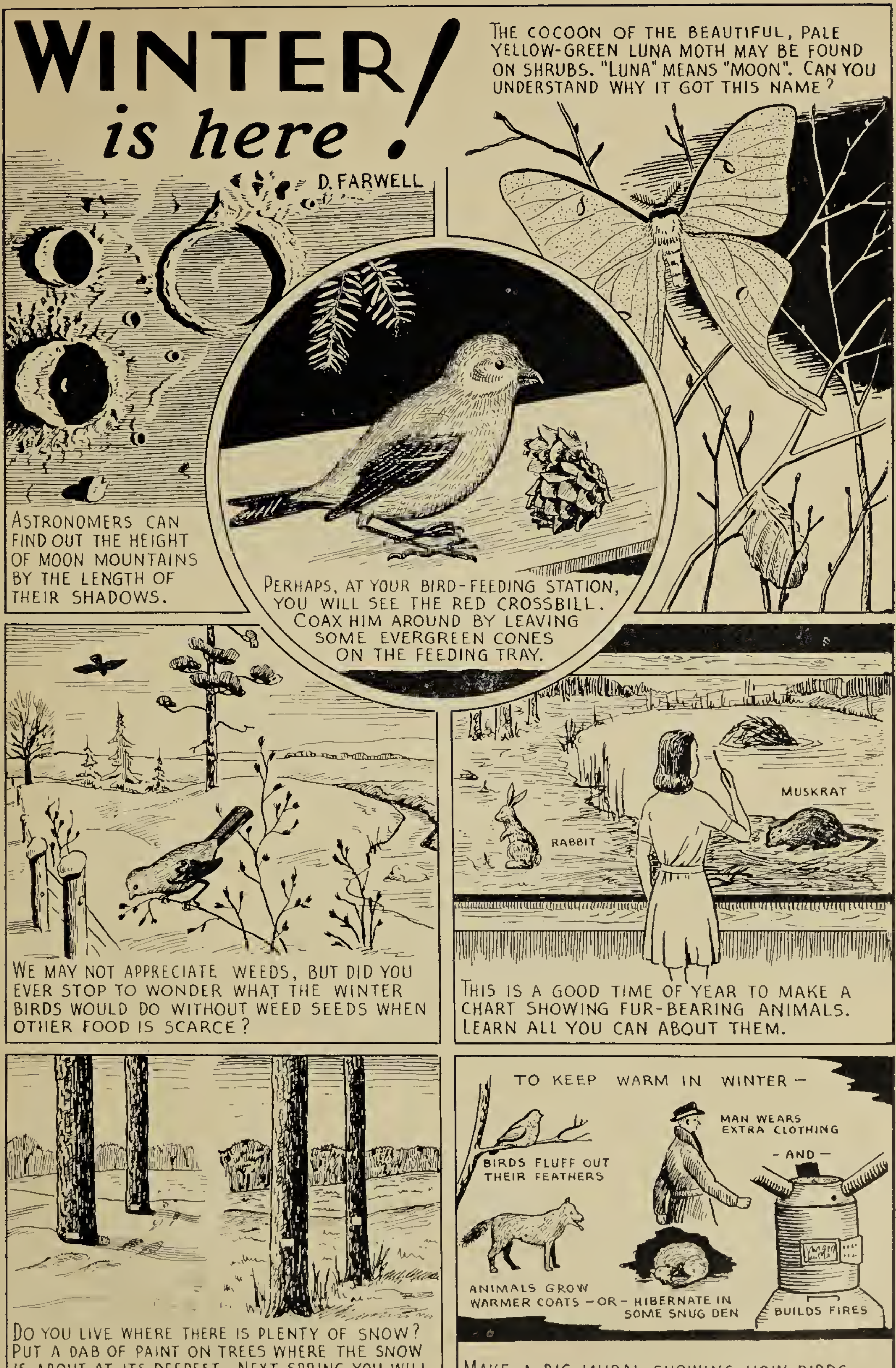
HOW ARE A RABBIT'S TEETH FITTED FOR ITS WAY OF LIFE? A CAT'S?



PART OF RABBIT SKULL
NOTICE FLATTENED TEETH OF RABBIT AND POINTED TEETH OF CAT.
SKULL OF CAT

WINTER! is here!

D. FARWELL


MUSKRAT
RABBIT
TO KEEP WARM IN WINTER —
MAN WEARS EXTRA CLOTHING
- AND -
BUILDS FIRES
BIRDS FLUFF OUT THEIR FEATHERS
ANIMALS GROW WARMER COATS — OR — HIBERNATE IN SOME SNUG DEN

THE COCOON OF THE BEAUTIFUL, PALE YELLOW-GREEN LUNA MOTH MAY BE FOUND ON SHRUBS. "LUNA" MEANS "MOON". CAN YOU UNDERSTAND WHY IT GOT THIS NAME?

ASTRONOMERS CAN FIND OUT THE HEIGHT OF MOON MOUNTAINS BY THE LENGTH OF THEIR SHADOWS.

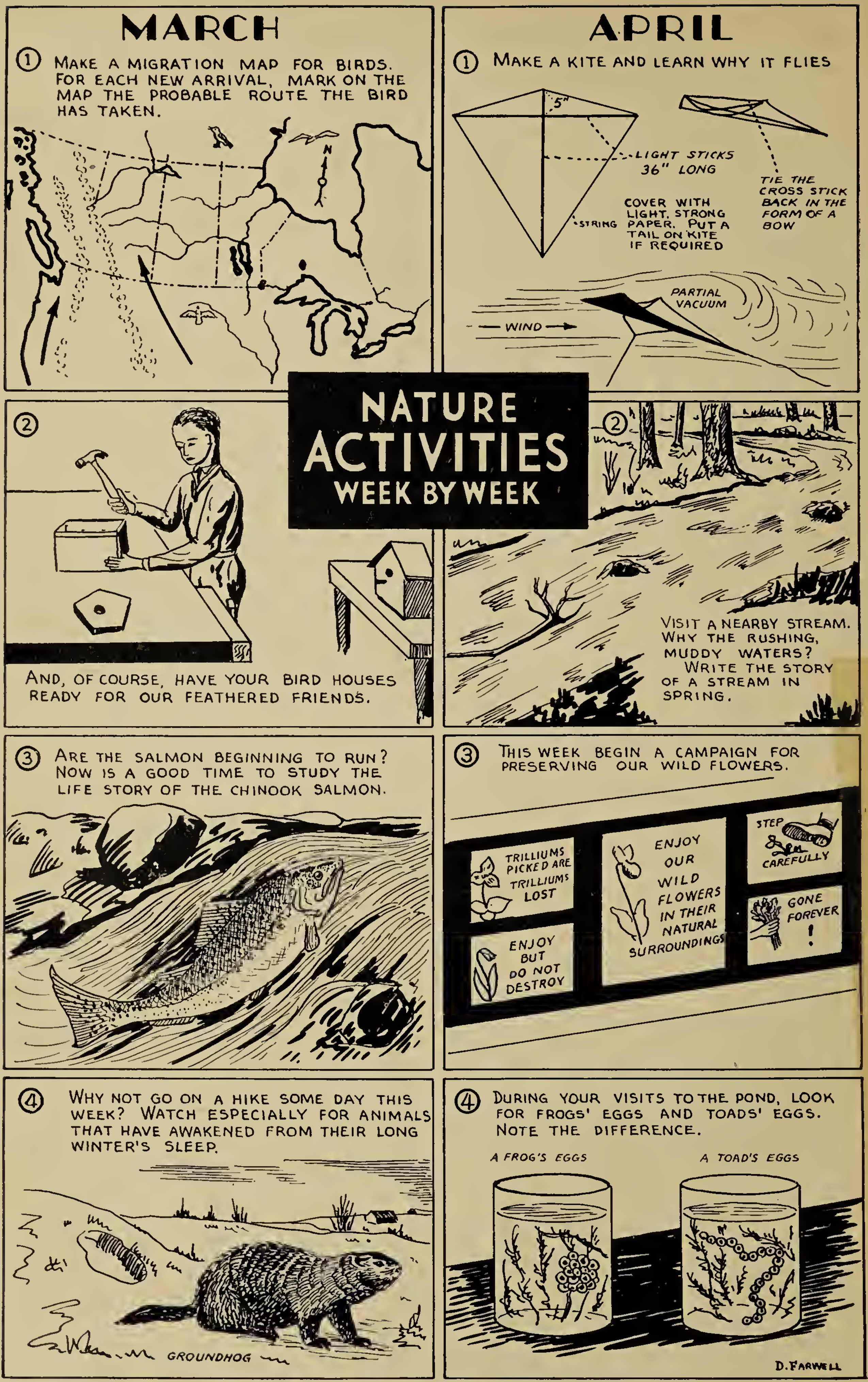
PERHAPS, AT YOUR BIRD-FEEDING STATION, YOU WILL SEE THE RED CROSSBILL. COAX HIM AROUND BY LEAVING SOME EVERGREEN CONES ON THE FEEDING TRAY.

WE MAY NOT APPRECIATE WEEDS, BUT DID YOU EVER STOP TO WONDER WHAT THE WINTER BIRDS WOULD DO WITHOUT WEED SEEDS WHEN OTHER FOOD IS SCARCE?

THIS IS A GOOD TIME OF YEAR TO MAKE A CHART SHOWING FUR-BEARING ANIMALS. LEARN ALL YOU CAN ABOUT THEM.

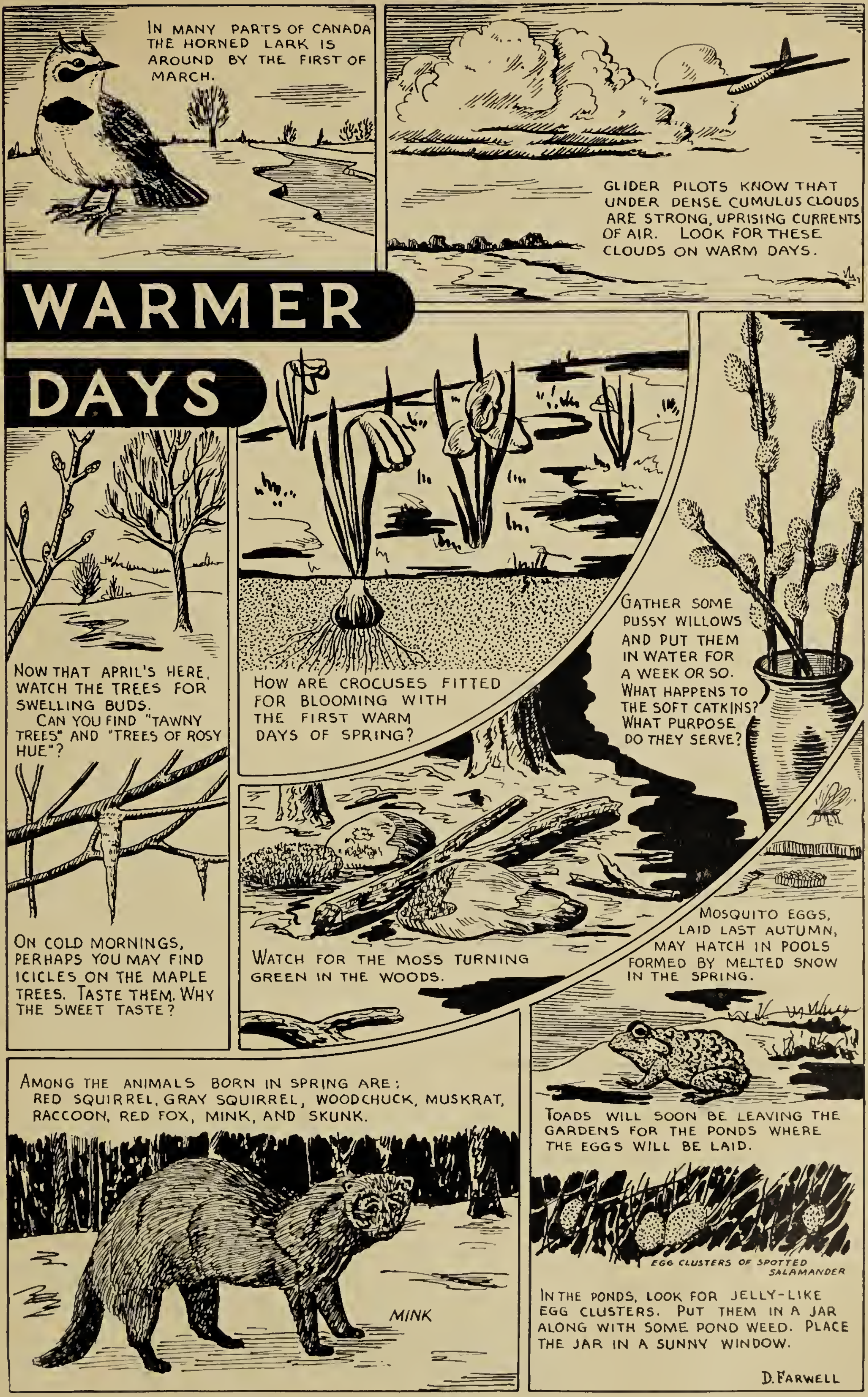
DO YOU LIVE WHERE THERE IS PLENTY OF SNOW? PUT A DAB OF PAINT ON TREES WHERE THE SNOW IS ABOUT AT ITS DEEPEST. NEXT SPRING YOU WILL KNOW HOW DEEP THE SNOW WAS DURING THE WINTER.

MAKE A BIG MURAL SHOWING HOW BIRDS, ANIMALS, AND PEOPLE KEEP WARM IN WINTER.


MARCH
① MAKE A MIGRATION MAP FOR BIRDS. FOR EACH NEW ARRIVAL, MARK ON THE MAP THE PROBABLE ROUTE THE BIRD HAS TAKEN.
N
APRIL
① MAKE A KITE AND LEARN WHY IT FLIES
5"
LIGHT STICKS 36" LONG
TIE THE CROSS STICK BACK IN THE FORM OF A BOW
STRING
COVER WITH LIGHT, STRONG PAPER. PUT A TAIL ON KITE IF REQUIRED
PARTIAL VACUUM
WIND
NATURE ACTIVITIES WEEK BY WEEK
②
AND, OF COURSE, HAVE YOUR BIRD HOUSES READY FOR OUR FEATHERED FRIENDS.
②
VISIT A NEARBY STREAM. WHY THE RUSHING, MUDDY WATERS? WRITE THE STORY OF A STREAM IN SPRING.
③ ARE THE SALMON BEGINNING TO RUN? NOW IS A GOOD TIME TO STUDY THE LIFE STORY OF THE CHINOOK SALMON.
③ THIS WEEK BEGIN A CAMPAIGN FOR PRESERVING OUR WILD FLOWERS.
TRILLIUMS PICKED ARE TRILLIUMS LOST
ENJOY OUR WILD FLOWERS IN THEIR NATURAL SURROUNDINGS
STEP CAREFULLY
ENJOY BUT DO NOT DESTROY
GONE FOREVER !
④ WHY NOT GO ON A HIKE SOME DAY THIS WEEK? WATCH ESPECIALLY FOR ANIMALS THAT HAVE AWAKENED FROM THEIR LONG WINTER'S SLEEP.
GROUNDHOG
④ DURING YOUR VISITS TO THE POND, LOOK FOR FROGS' EGGS AND TOADS' EGGS. NOTE THE DIFFERENCE.
A FROG'S EGGS
A TOAD'S EGGS
D. FARWELL

MARCH AND APRIL

WARMER DAYS



IN MANY PARTS OF CANADA THE HORNED LARK IS AROUND BY THE FIRST OF MARCH.

GLIDER PILOTS KNOW THAT UNDER DENSE CUMULUS CLOUDS ARE STRONG, UPRISING CURRENTS OF AIR. LOOK FOR THESE CLOUDS ON WARM DAYS.

NOW THAT APRIL'S HERE, WATCH THE TREES FOR SWELLING BUDS.

CAN YOU FIND "TAWNY TREES" AND "TREES OF ROSY HUE"?

HOW ARE CROCUSES FITTED FOR BLOOMING WITH THE FIRST WARM DAYS OF SPRING?

GATHER SOME PUSSY WILLOWS AND PUT THEM IN WATER FOR A WEEK OR SO. WHAT HAPPENS TO THE SOFT CATKINS? WHAT PURPOSE DO THEY SERVE?

ON COLD MORNINGS, PERHAPS YOU MAY FIND ICICLES ON THE MAPLE TREES. TASTE THEM. WHY THE SWEET TASTE?

WATCH FOR THE MOSS TURNING GREEN IN THE WOODS.

MOSQUITO EGGS, LAID LAST AUTUMN, MAY HATCH IN POOLS FORMED BY MELTED SNOW IN THE SPRING.

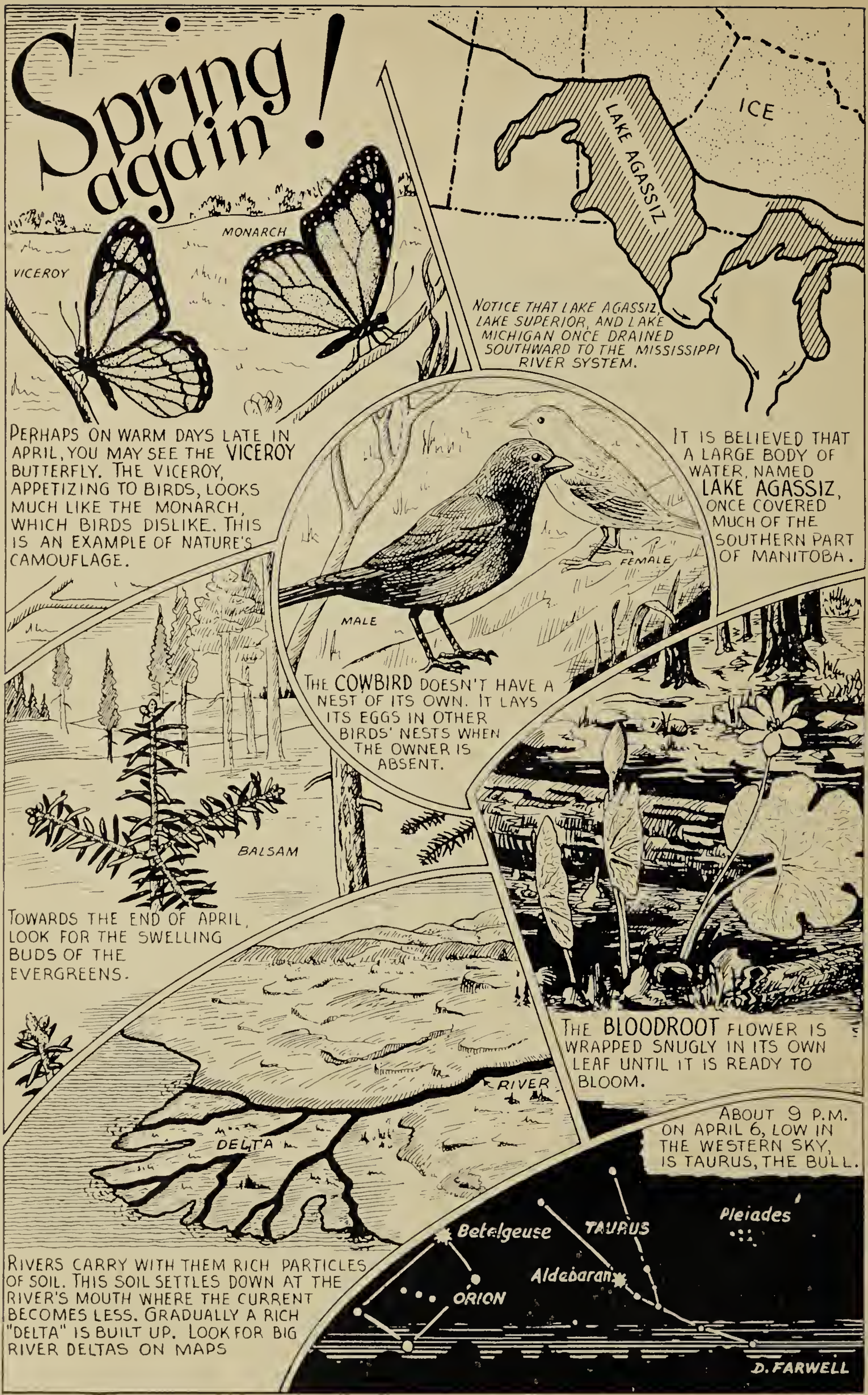
AMONG THE ANIMALS BORN IN SPRING ARE: RED SQUIRREL, GRAY SQUIRREL, WOODCHUCK, MUSKRAT, RACCOON, RED FOX, MINK, AND SKUNK.

TOADS WILL SOON BE LEAVING THE GARDENS FOR THE PONDS WHERE THE EGGS WILL BE LAID.

IN THE PONDS, LOOK FOR JELLY-LIKE EGG CLUSTERS. PUT THEM IN A JAR ALONG WITH SOME POND WEED. PLACE THE JAR IN A SUNNY WINDOW.

D. FARWELL

Spring again!



PERHAPS ON WARM DAYS LATE IN APRIL, YOU MAY SEE THE **VICEROY** BUTTERFLY. THE VICEROY, APPETIZING TO BIRDS, LOOKS MUCH LIKE THE MONARCH, WHICH BIRDS DISLIKE. THIS IS AN EXAMPLE OF NATURE'S CAMOUFLAGE.

NOTICE THAT LAKE AGASSIZ LAKE SUPERIOR, AND LAKE MICHIGAN ONCE DRAINED SOUTHWARD TO THE MISSISSIPPI RIVER SYSTEM.

IT IS BELIEVED THAT A LARGE BODY OF WATER, NAMED **LAKE AGASSIZ**, ONCE COVERED MUCH OF THE SOUTHERN PART OF MANITOBA.

THE **COWBIRD** DOESN'T HAVE A NEST OF ITS OWN. IT LAYS ITS EGGS IN OTHER BIRDS' NESTS WHEN THE OWNER IS ABSENT.

TOWARDS THE END OF APRIL, LOOK FOR THE SWELLING BUDS OF THE EVERGREENS.

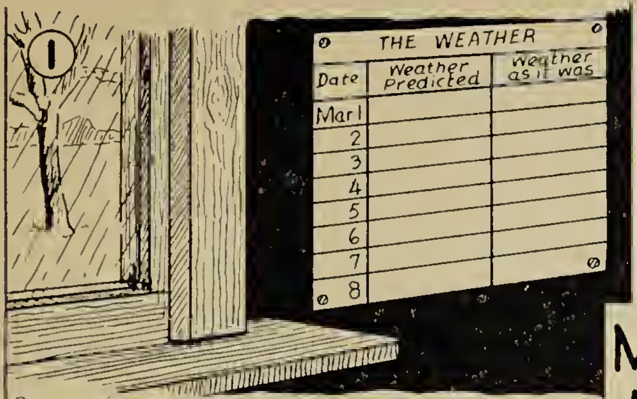
THE **BLOODROOT** FLOWER IS WRAPPED SNUGLY IN ITS OWN LEAF UNTIL IT IS READY TO BLOOM.

RIVERS CARRY WITH THEM RICH PARTICLES OF SOIL. THIS SOIL SETTLES DOWN AT THE RIVER'S MOUTH WHERE THE CURRENT BECOMES LESS. GRADUALLY A RICH "DELTA" IS BUILT UP. LOOK FOR BIG RIVER DELTAS ON MAPS

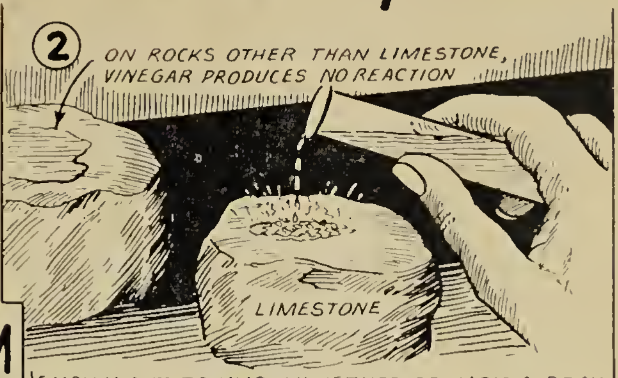
ABOUT 9 P.M. ON APRIL 6, LOW IN THE WESTERN SKY, IS TAURUS, THE BULL.

Nature Activities -- Week by Week

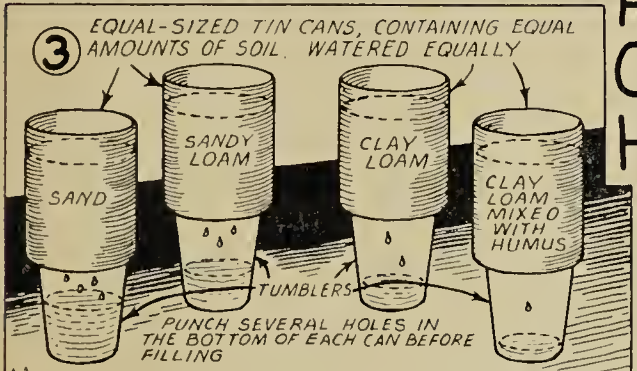
MARCH



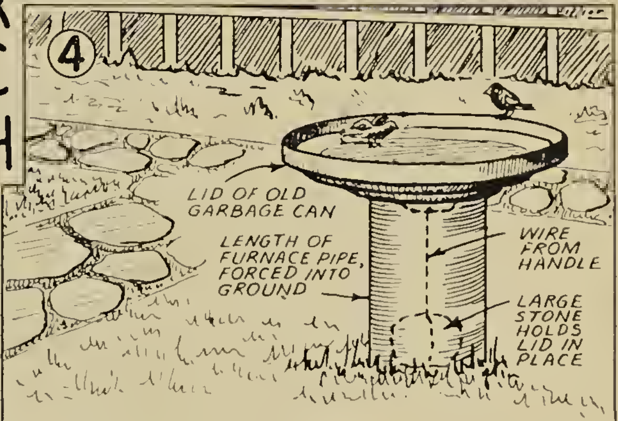
By means of a chart, check the accuracy of the daily weather forecast.


2
ON ROCKS OTHER THAN LIMESTONE, VINEGAR PRODUCES NO REACTION
LIMESTONE

If you want to know whether or not a rock is limestone, put a little vinegar on it. On limestone the liquid will bubble up — "effervesce" is the word.

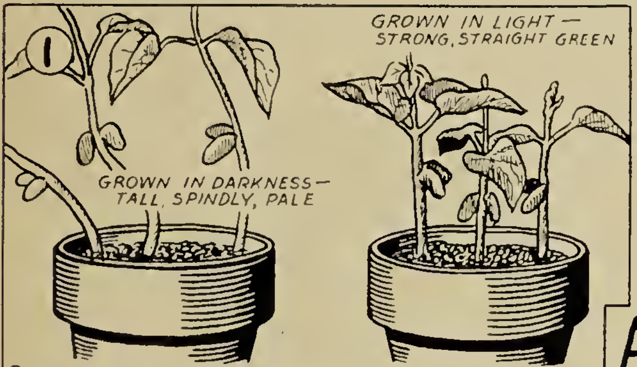

3
EQUAL-SIZED TIN CANS, CONTAINING EQUAL AMOUNTS OF SOIL. WATERED EQUALLY
SAND
SANDY LOAM
CLAY LOAM
CLAY LOAM MIXED WITH HUMUS
TUMBLERS
PUNCH SEVERAL HOLES IN THE BOTTOM OF EACH CAN BEFORE FILLING

Make a test of the water-holding qualities of various soils. Which of these is best for farming?


4
LID OF OLD GARBAGE CAN
LENGTH OF FURNACE PIPE, FORCED INTO GROUND
WIRE FROM HANDLE
LARGE STONE HOLDS LID IN PLACE

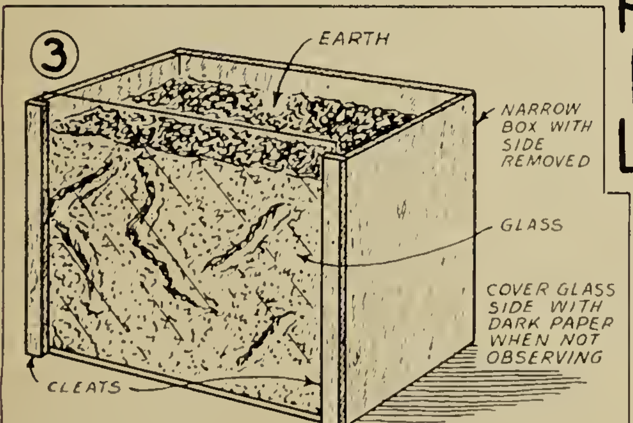
Make a bird bath for your garden.

APRIL

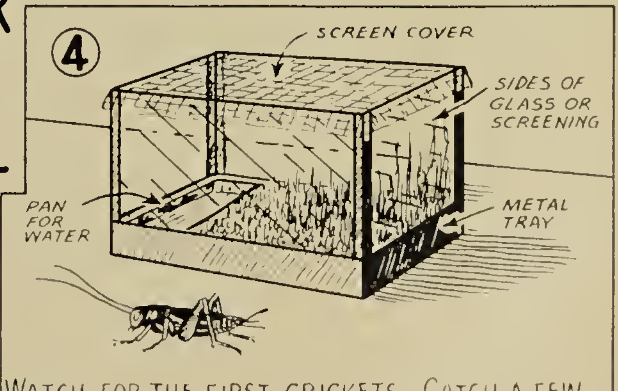

1
GROWN IN DARKNESS— TALL, SPINDLY, PALE
GROWN IN LIGHT— STRONG, STRAIGHT GREEN

Grow some corn or bean seedlings in a flower pot set in a dark closet. Grow others in a flower pot on the window sill. Water each set equally. Compare them two weeks later.

Begin a series of sketches on the appearance of one particular tree. Keep up the record until the tree is in full leaf.


3
EARTH
NARROW BOX WITH SIDE REMOVED
GLASS
COVER GLASS SIDE WITH DARK PAPER WHEN NOT OBSERVING
CLEATS

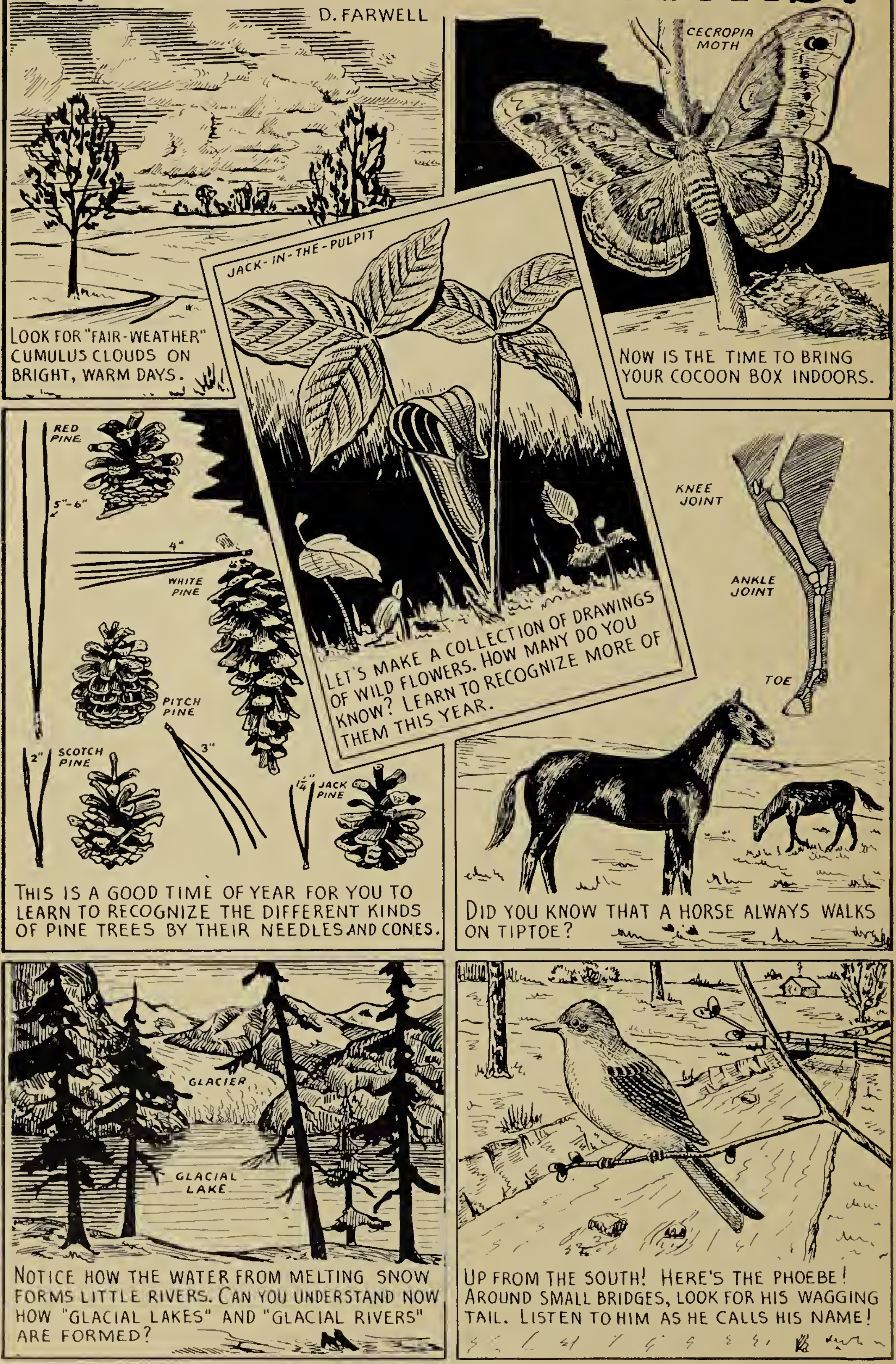
Make a home for several earthworms



Watch for the first crickets. Catch a few. Keep them in a terrarium. Try to find out how they chirp.

D Farwell

Nature Awakens!



LOOK FOR "FAIR-WEATHER" CUMULUS CLOUDS ON BRIGHT, WARM DAYS.

NOW IS THE TIME TO BRING YOUR COCOON BOX INDOORS.

LET'S MAKE A COLLECTION OF DRAWINGS OF WILD FLOWERS. HOW MANY DO YOU KNOW? LEARN TO RECOGNIZE MORE OF THEM THIS YEAR.

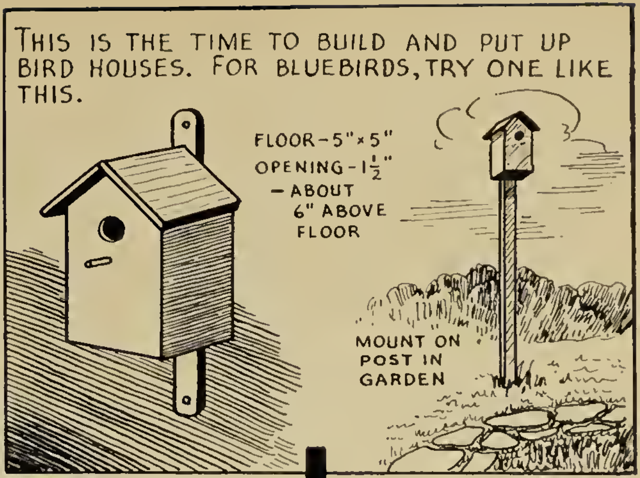
THIS IS A GOOD TIME OF YEAR FOR YOU TO LEARN TO RECOGNIZE THE DIFFERENT KINDS OF PINE TREES BY THEIR NEEDLES AND CONES.

DID YOU KNOW THAT A HORSE ALWAYS WALKS ON TIPTOE?

NOTICE HOW THE WATER FROM MELTING SNOW FORMS LITTLE RIVERS. CAN YOU UNDERSTAND NOW HOW "GLACIAL LAKES" AND "GLACIAL RIVERS" ARE FORMED?

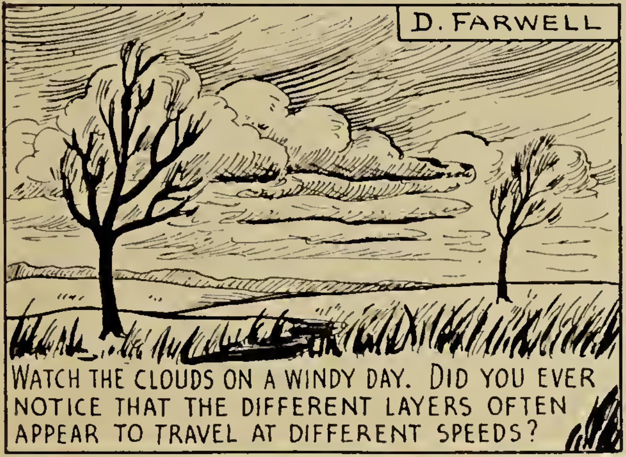
UP FROM THE SOUTH! HERE'S THE PHOEBE! AROUND SMALL BRIDGES, LOOK FOR HIS WAGGING TAIL. LISTEN TO HIM AS HE CALLS HIS NAME!

ICICLES SOMETIMES LEAN AWAY FROM THE WIND.

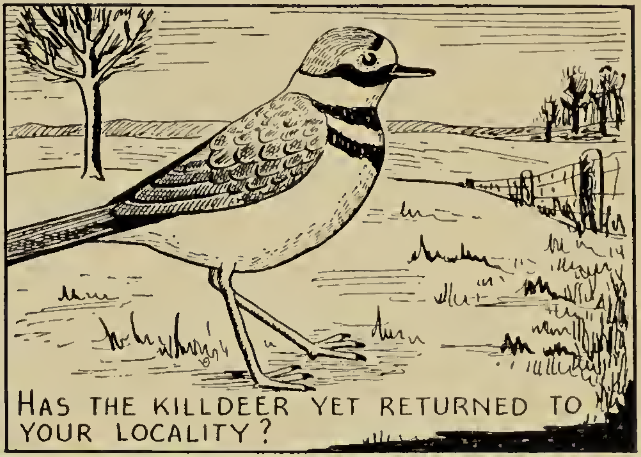


THIS IS THE TIME TO BUILD AND PUT UP BIRD HOUSES. FOR BLUEBIRDS, TRY ONE LIKE THIS.

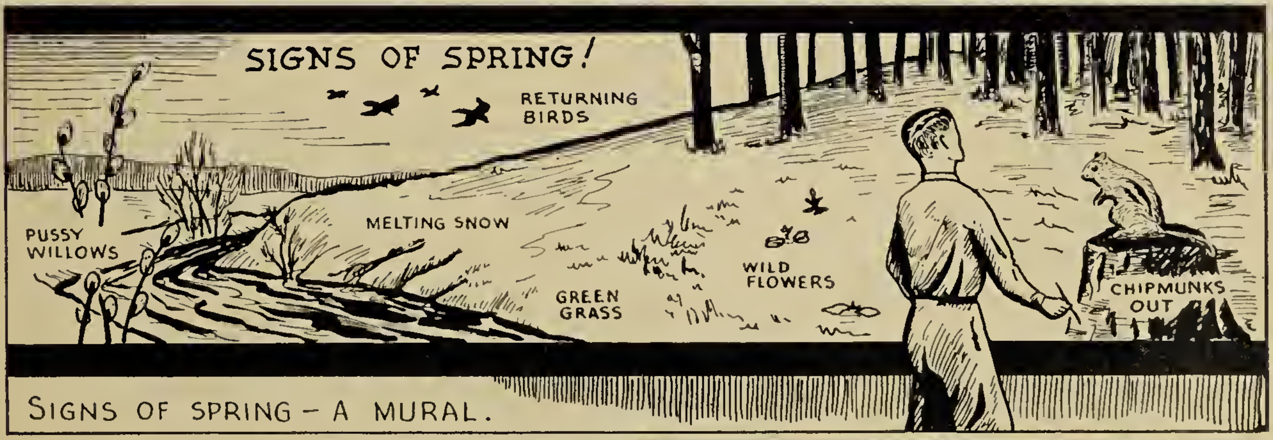
AWAKENING LIFE



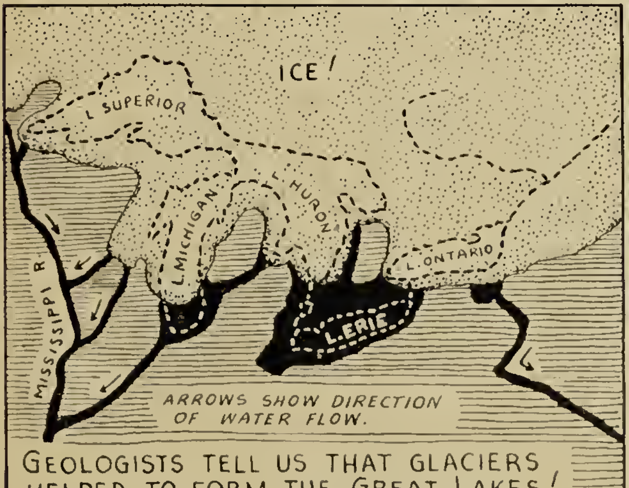
WATCH THE CLOUDS ON A WINDY DAY. DID YOU EVER NOTICE THAT THE DIFFERENT LAYERS OFTEN APPEAR TO TRAVEL AT DIFFERENT SPEEDS?



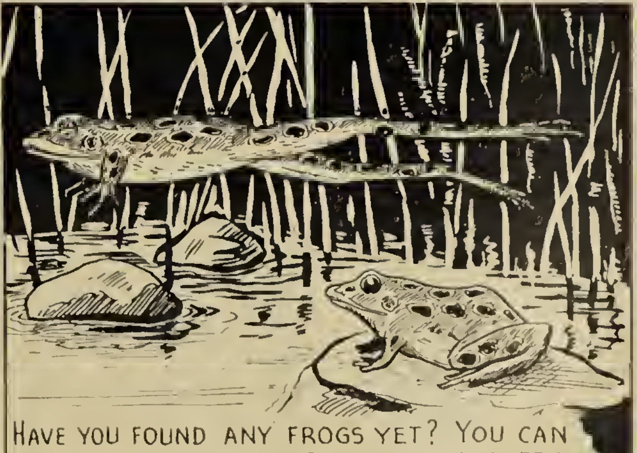
HAS THE KILLDEER YET RETURNED TO YOUR LOCALITY?



SIGNS OF SPRING – A MURAL.

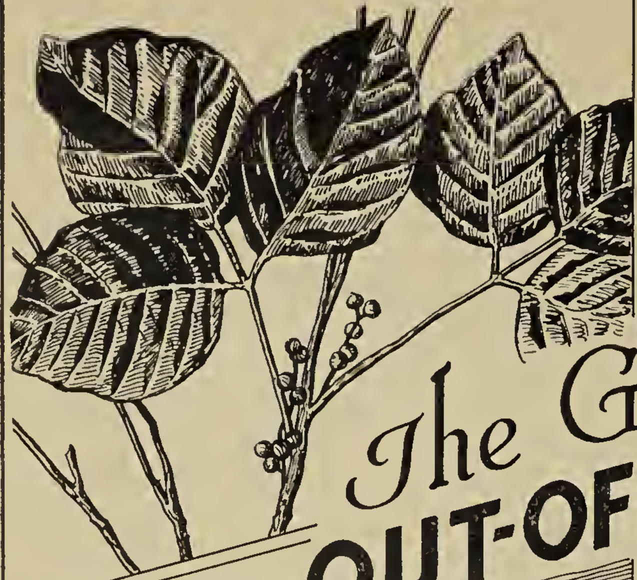


GEOLOGISTS TELL US THAT GLACIERS HELPED TO FORM THE GREAT LAKES!



HAVE YOU FOUND ANY FROGS YET? YOU CAN SEE FROM THIS DRAWING OF A LEOPARD FROG IN THE MIDDLE OF HIS LEAP HOW LONG HIS LEGS ARE.

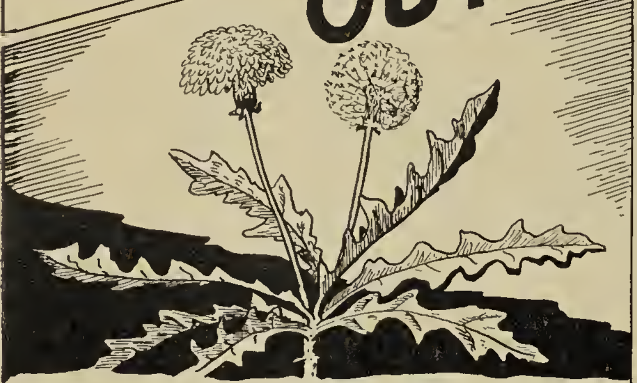
POISON IVY IS A NUISANCE. MAKE SURE THAT YOU KNOW IT — AND DON'T TOUCH IT!



DID YOU EVER STOP TO ADMIRE A SPIDER'S SILKEN WEB — PERHAPS ONE STUDDED WITH PEARLS OF DEW?

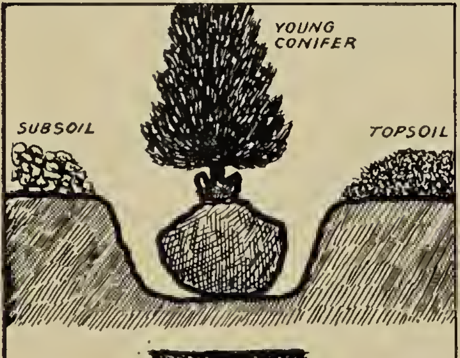
The Great OUT-OF-DOORS

D. FARWELL

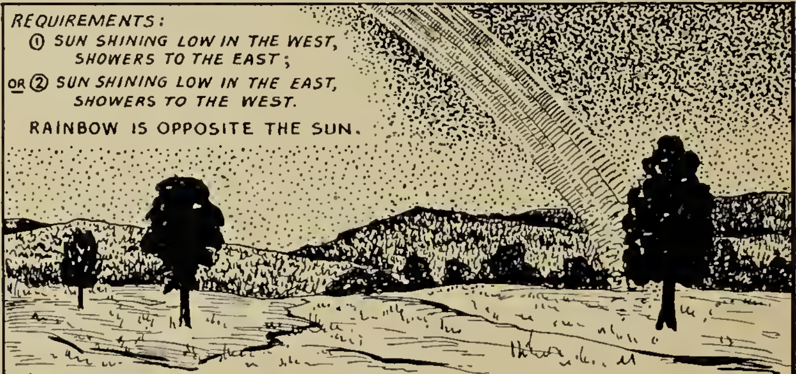


IT IS SAID THAT THE DANDELION GOT ITS NAME FROM THE FRENCH — "DENT DE LION", OR LION'S TOOTH. CAN YOU SEE HOW?

WATCH BIRDS BUILDING NESTS. WHAT SORT OF MATERIALS DO THEY USE?



PLANT A TREE FOR ORNAMENT OR SHADE.



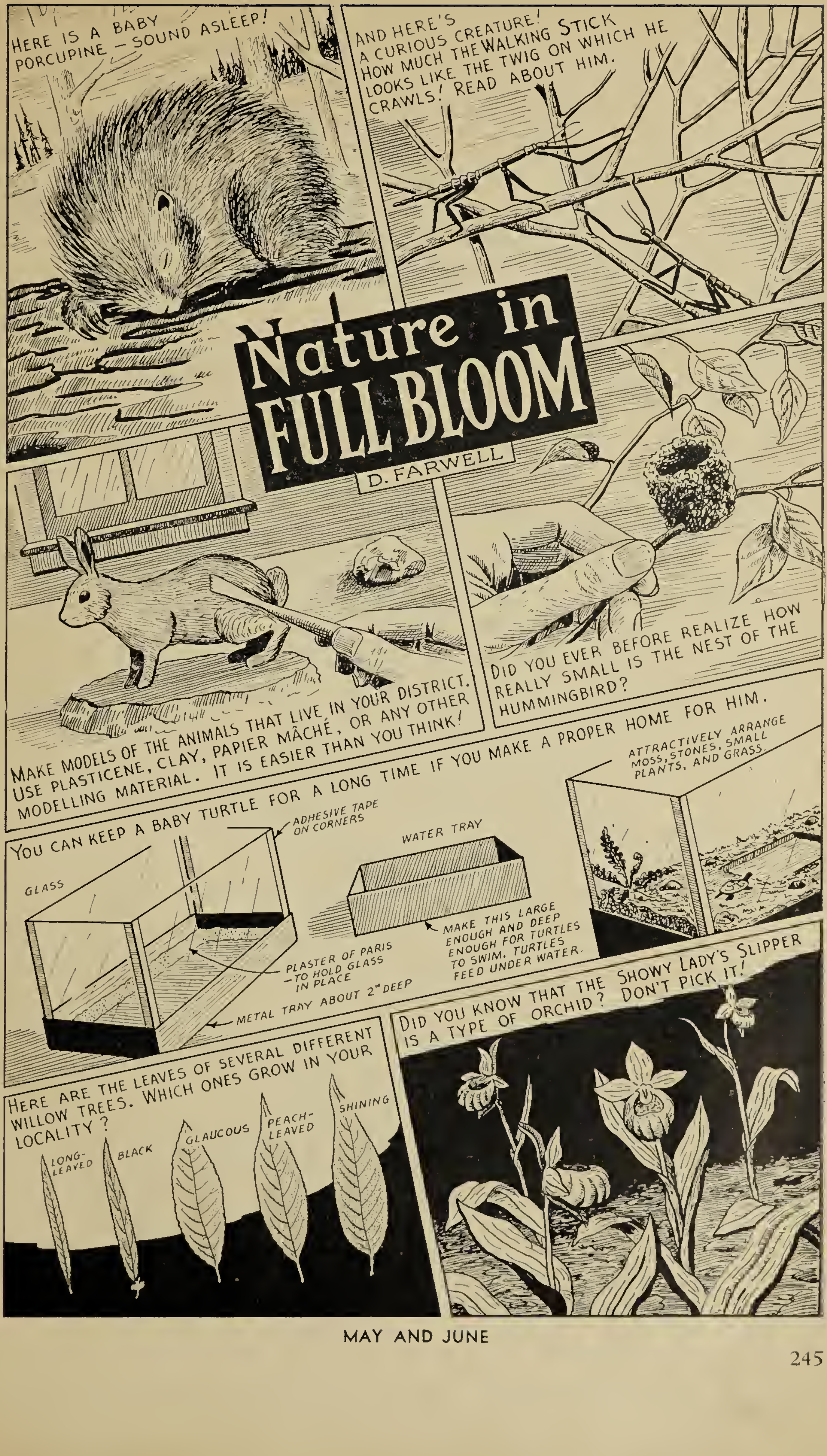
REQUIREMENTS:
① SUN SHINING LOW IN THE WEST, SHOWERS TO THE EAST;
OR ② SUN SHINING LOW IN THE EAST, SHOWERS TO THE WEST.
RAINBOW IS OPPOSITE THE SUN.

YOU ALL HAVE SEEN RAINBOWS, BUT DO YOU KNOW WHEN AND WHERE TO LOOK FOR THEM?

SOME WARM SPRING EVENING, WHEN THE MOON IS BRIGHT, TRY A SKETCH OF A SCENE THAT APPEALS TO YOU.

Nature in FULL BLOOM

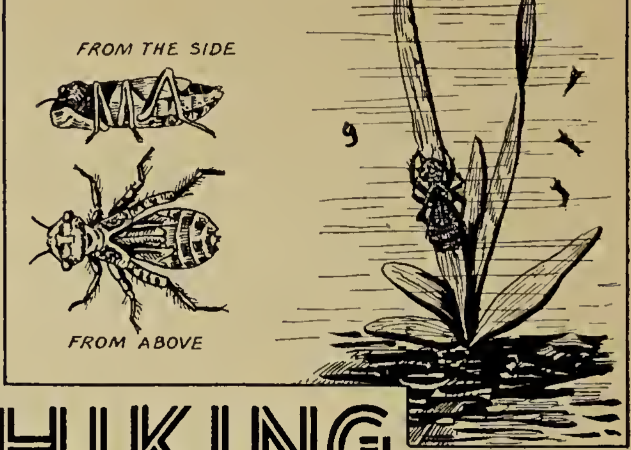
D. FARWELL

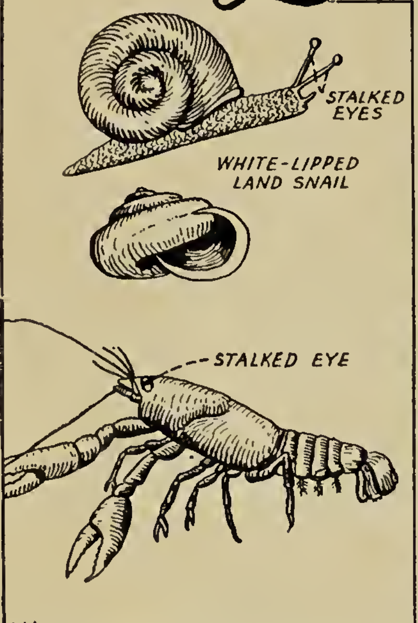

HERE IS A BABY PORCUPINE — SOUND ASLEEP!
AND HERE'S A CURIOUS CREATURE! HOW MUCH THE WALKING STICK LOOKS LIKE THE TWIG ON WHICH HE CRAWLS! READ ABOUT HIM.
DID YOU EVER BEFORE REALIZE HOW REALLY SMALL IS THE NEST OF THE HUMMINGBIRD?
MAKE MODELS OF THE ANIMALS THAT LIVE IN YOUR DISTRICT. USE PLASTICENE, CLAY, PAPIER MÂCHÉ, OR ANY OTHER MODELLING MATERIAL. IT IS EASIER THAN YOU THINK!
YOU CAN KEEP A BABY TURTLE FOR A LONG TIME IF YOU MAKE A PROPER HOME FOR HIM.
GLASS
ADHESIVE TAPE ON CORNERS
PLASTER OF PARIS — TO HOLD GLASS IN PLACE
METAL TRAY ABOUT 2" DEEP
WATER TRAY
MAKE THIS LARGE ENOUGH AND DEEP ENOUGH FOR TURTLES TO SWIM. TURTLES FEED UNDER WATER.
ATTRACTIVELY ARRANGE MOSS, STONES, SMALL PLANTS, AND GRASS.
HERE ARE THE LEAVES OF SEVERAL DIFFERENT WILLOW TREES. WHICH ONES GROW IN YOUR LOCALITY?
LONG-LEAVED
BLACK
GLAUCOUS
PEACH-LEAVED
SHINING
DID YOU KNOW THAT THE SHOWY LADY'S SLIPPER IS A TYPE OF ORCHID? DON'T PICK IT!

Let's go HIKING

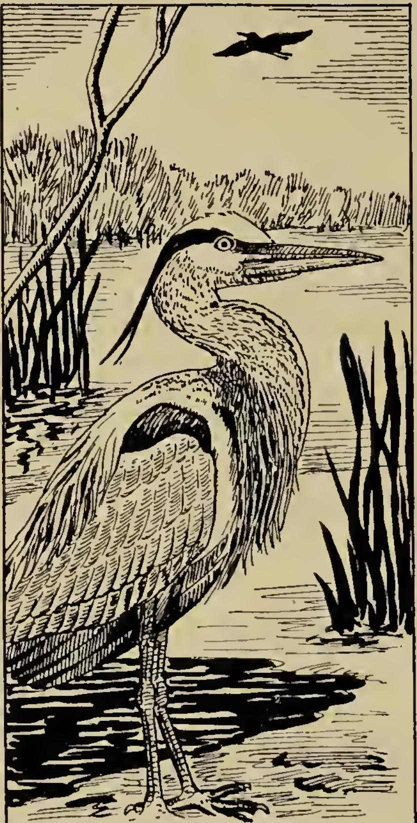
ON YOUR HIKE, LOOK FOR THE MILKWEED IN FLOWER.

DRAGON-FLY NYMPHS ARE SAVAGE UNDERWATER HUNTERS. MOSQUITO LARVAE FORM A LARGE PART OF THEIR DIET.

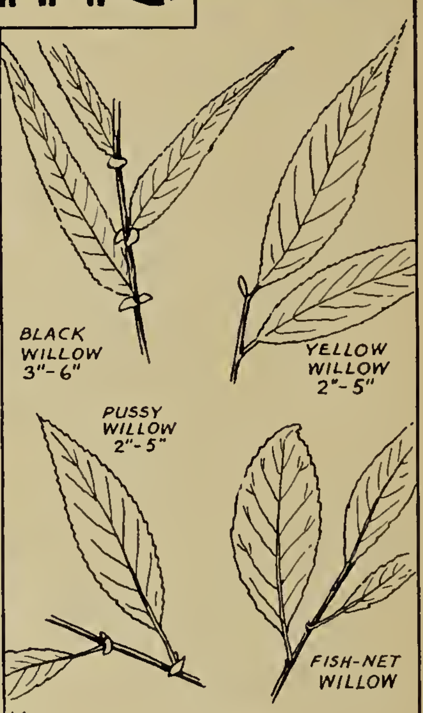




WHAT AN ADVANTAGE IT IS FOR SNAILS AND CRAYFISH TO BE ABLE TO SEE IN ALL DIRECTIONS!

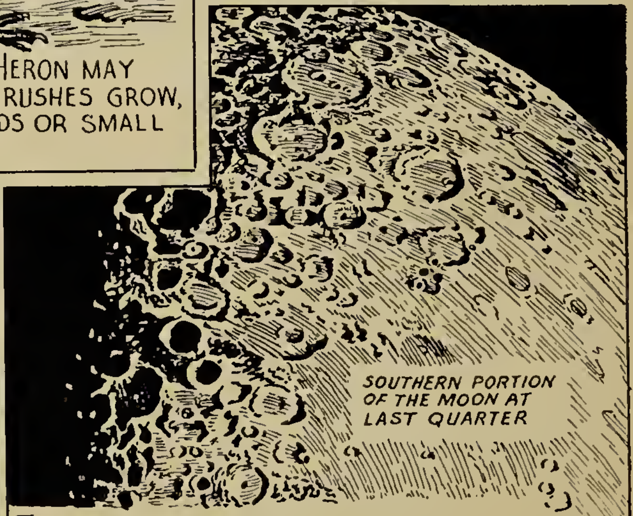


THE GREAT BLUE HERON MAY BE SEEN WHERE RUSHES GROW, NEAR LARGE PONDS OR SMALL LAKES.



HERE ARE SOME MORE LEAVES FOR YOU TO RECOGNIZE.

"SOMEONE LEFT HIS CAMPFIRE BURNING!"


SOUTHERN PORTION OF THE MOON AT LAST QUARTER

THIS IS WHAT THE MOON LOOKS LIKE THROUGH A TELESCOPE.

D. FARWELL

NATURE ACTIVITIES WEEK BY WEEK

MAY

① SELECT A BEAUTY SPOT IN A PARK, THE WOODS, OR ALONG A STREAM AND OBSERVE THE CHANGES THAT TAKE PLACE DURING THE LATE SPRING MONTHS.

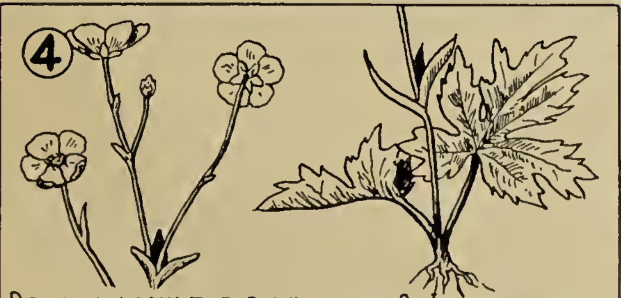
②

PLACE A BOARD OVER SOME GREEN GRASS AND LEAVE IT FOR A FEW DAYS. NOTICE HOW YELLOW THE GRASS BECOMES. THIS TEST HELPS TO SHOW THAT LIGHT IS NECESSARY FOR THE PRODUCTION OF GREEN COLOURING IN PLANTS.

③

BEGIN, AND KEEP UP, A SERIES OF LITTLE SKETCHES SHOWING THE DEVELOPMENT OF A CHERRY.

④

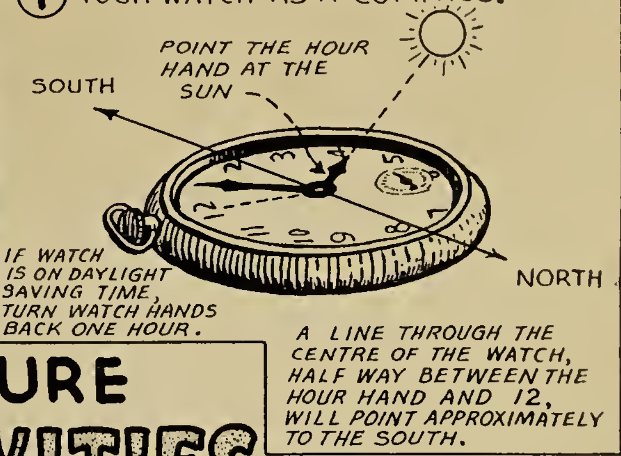


DO YOU KNOW THE BUTTERCUP? IT GROWS IN ENGLAND, TOO. READ WHAT ROBERT BROWNING THINKS OF IT IN HIS POEM, "HOME THOUGHTS, FROM ABROAD".

D. FARWELL

JUNE

① IT IS HANDY TO KNOW HOW TO USE YOUR WATCH AS A COMPASS.

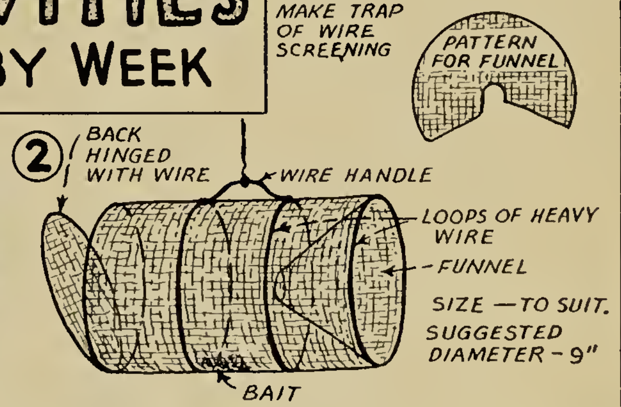


IF WATCH IS ON DAYLIGHT SAVING TIME, TURN WATCH HANDS BACK ONE HOUR.

A LINE THROUGH THE CENTRE OF THE WATCH, HALF WAY BETWEEN THE HOUR HAND AND 12, WILL POINT APPROXIMATELY TO THE SOUTH.

②

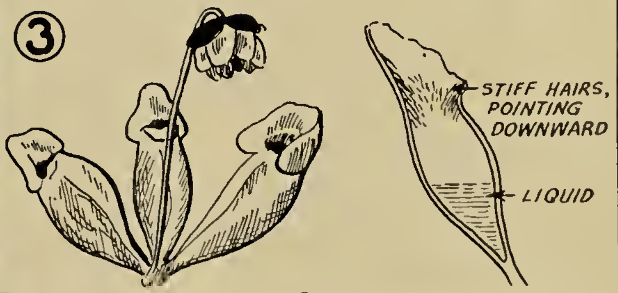
MAKE TRAP OF WIRE SCREENING



SIZE — TO SUIT. SUGGESTED DIAMETER - 9"

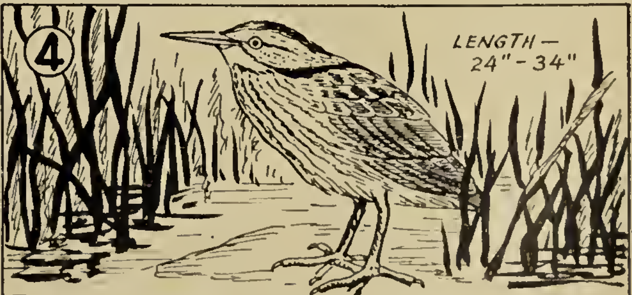
DO YOU USE MINNOWS FOR BAIT WHEN YOU FISH? THIS HOME-MADE MINNOW TRAP, SET FOR A FEW HOURS, SHOULD KEEP YOU SUPPLIED.

③

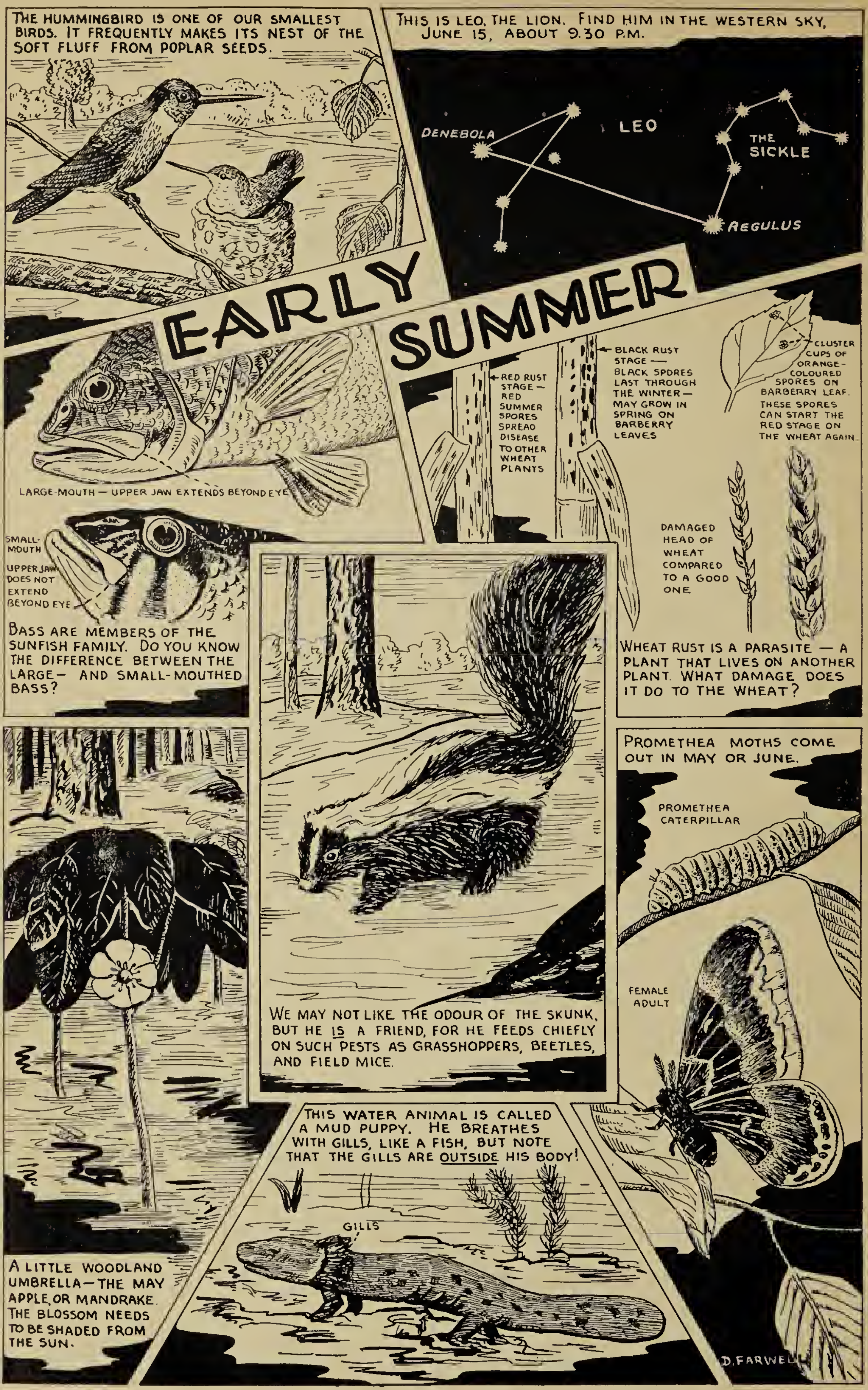


FIND A PITCHER PLANT. CAREFULLY TAKE APART ONE OF ITS LEAVES. NOTICE WHAT AN EFFECTIVE TRAP IT IS FOR THE INSECT THAT WOULD VENTURE TOWARDS THE SWEET, STICKY LIQUID INSIDE!

④



TAKE A TRIP TO A REEDY POND AND LOOK FOR NEW BIRDS. THIS ONE IS THE AMERICAN BITTERN. HOW DO HIS LONG LEGS AND PROTECTIVE COLOURING HELP HIM IN HIS WAY OF LIFE?


EARLY SUMMER
DENEBOLA
LEO
THE SICKLE
REGULUS
LARGE-MOUTH — UPPER JAW EXTENDS BEYOND EYE
SMALL-MOUTH
UPPER JAW DOES NOT EXTEND BEYOND EYE
RED RUST STAGE — RED SUMMER SPORES SPREAD DISEASE TO OTHER WHEAT PLANTS
BLACK RUST STAGE — BLACK SPORES LAST THROUGH THE WINTER — MAY GROW IN SPRING ON BARBERRY LEAVES
CLUSTER CUPS OF ORANGE-COLOURED SPORES ON BARBERRY LEAF. THESE SPORES CAN START THE RED STAGE ON THE WHEAT AGAIN.
DAMAGED HEAD OF WHEAT COMPARED TO A GOOD ONE
PROMETHEA CATERPILLAR
FEMALE ADULT
GILLS
D. FARWELL

THE HUMMINGBIRD IS ONE OF OUR SMALLEST BIRDS. IT FREQUENTLY MAKES ITS NEST OF THE SOFT FLUFF FROM POPLAR SEEDS.

THIS IS LEO, THE LION. FIND HIM IN THE WESTERN SKY, JUNE 15, ABOUT 9.30 P.M.

BASS ARE MEMBERS OF THE SUNFISH FAMILY. DO YOU KNOW THE DIFFERENCE BETWEEN THE LARGE- AND SMALL-MOUTHED BASS?

WHEAT RUST IS A PARASITE — A PLANT THAT LIVES ON ANOTHER PLANT. WHAT DAMAGE DOES IT DO TO THE WHEAT?

PROMETHEA MOTHS COME OUT IN MAY OR JUNE.

WE MAY NOT LIKE THE ODOUR OF THE SKUNK, BUT HE IS A FRIEND, FOR HE FEEDS CHIEFLY ON SUCH PESTS AS GRASSHOPPERS, BEETLES, AND FIELD MICE.

A LITTLE WOODLAND UMBRELLA — THE MAY APPLE, OR MANDRAKE. THE BLOSSOM NEEDS TO BE SHADED FROM THE SUN.

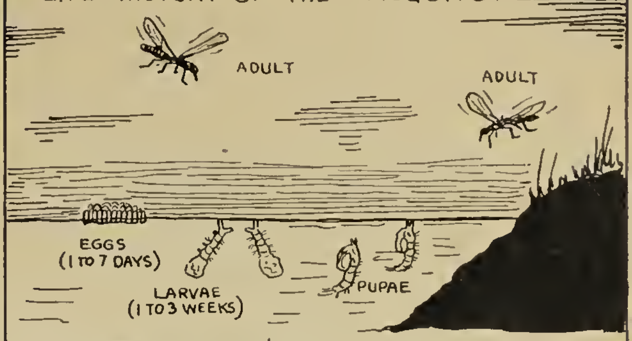
THIS WATER ANIMAL IS CALLED A MUD PUPPY. HE BREATHES WITH GILLS, LIKE A FISH, BUT NOTE THAT THE GILLS ARE OUTSIDE HIS BODY!

MAY AND JUNE

SUNNY DAYS

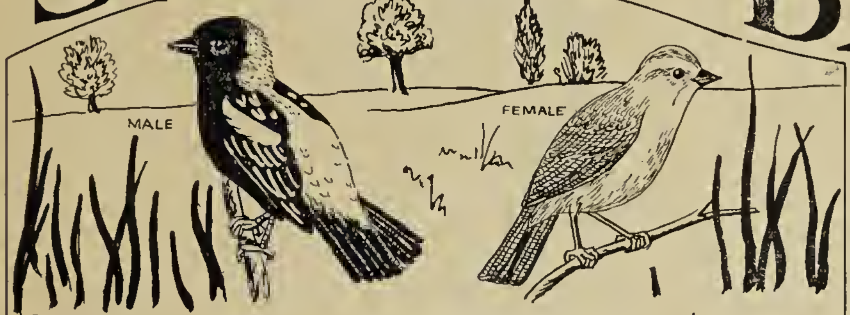
THIS IS THE FLYING SQUIRREL. HOW DOES IT FLY?

LIFE HISTORY OF THE MOSQUITO:

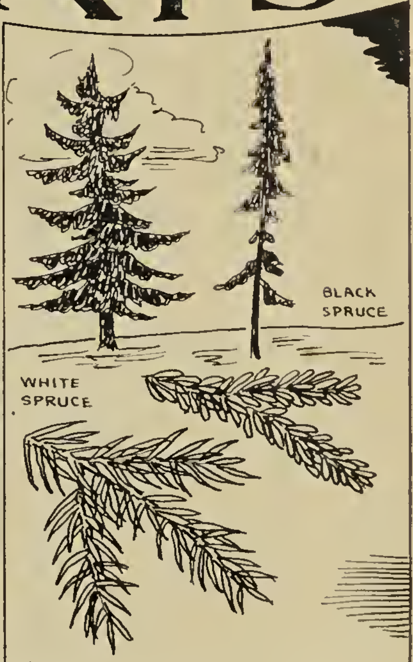


MOSQUITO SEASON! DID YOU KNOW THAT ONLY THE FEMALE MOSQUITO WILL BITE YOU? THE MALE IS STRICTLY VEGETARIAN IN ITS DIET!

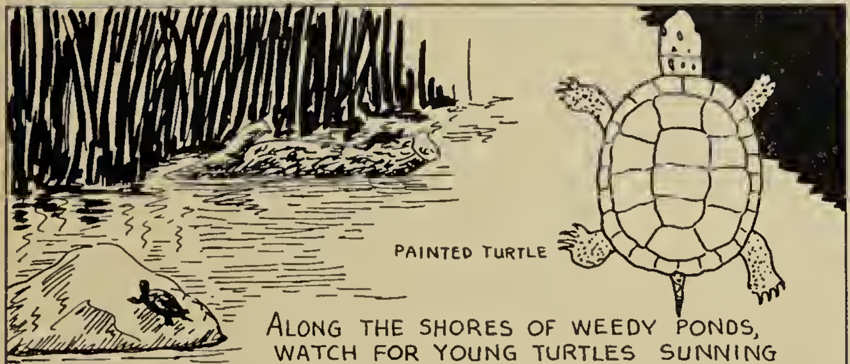
CONTROL MEASURES:
DRAIN POOLS OF STANDING WATER
COVER RAIN BARRELS
SPREAD THIN FILM OF OIL OVER STAGNANT WATER.



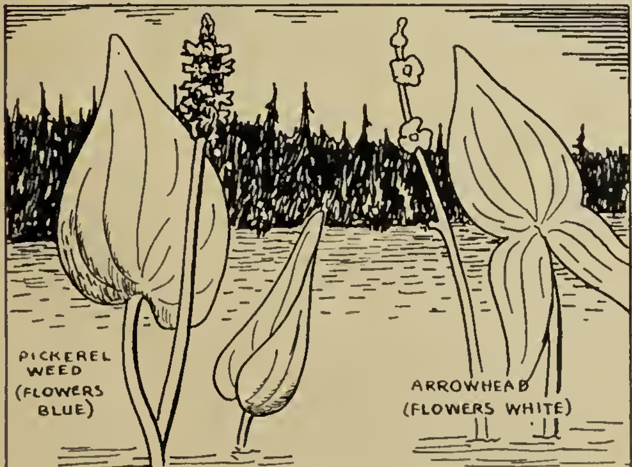
BOBOLINKS ARE WITH US FOR ONLY A SHORT TIME. LATE IN JULY THEY GATHER IN FLOCKS AND TRAVEL SOUTH.



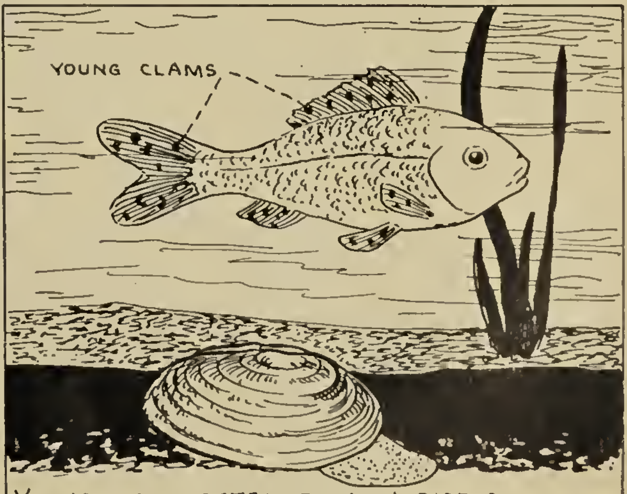
NEEDLES OF THE WHITE SPRUCE ARE SHARP-POINTED; OF THE BLACK SPRUCE, BLUNT-POINTED. NEEDLES OF BOTH ARE FOUR-SIDED IN CROSS SECTION.



ALONG THE SHORES OF WEEDY PONDS, WATCH FOR YOUNG TURTLES SUNNING THEMSELVES. CAN YOU CATCH ONE FOR YOUR VIVARIUM?



HERE ARE TWO OF OUR COMMON POND WEEDS. LOOK FOR FLOWERS LATER IN THE SUMMER.



YOUNG CLAMS OFTEN STEAL A RIDE ON THE FINS AND GILLS OF SOME SUITABLE PASSING FISH.

D. FARWELL

SECTION SIX

Recommended Reading

Please order direct from the respective publishers or through your book dealer. Addresses of publishers are given at end of the listings.
Letters following reference indicate age level, as: P—Primary: I—Intermediate: S—Secondary: A—Adult.

GENERAL REFERENCE

EARTH'S GRANDEST RIVERS. Ferdinand C. Lane. Doubleday. $4.25. Thousands of curious facts and anecdotes of the great rivers of the world. SA.

THE MYSTERIOUS SEA. Ferdinand C. Lane. Doubleday. $3.50. The lore of the sea: its history, topography, teeming life, countless anecdotes and odd facts. SA.

THE WORLD'S GREAT LAKES. Ferdinand C. Lane. Doubleday. $4.00. An easy-to-read book filled with a thousand curious and fascinating facts and anecdotes, about the world's lakes. SA.

THE STORY OF MOUNTAINS. Ferdinand C. Lane. Doubleday. 1950. $7.50. Everything there is to know about mountains; their origin, structure, vegetation, and importance in history and literature. SA.

THE STRANGE WORLD OF NATURE. Bernard Gooch. Ryerson. $2.75. A trained observer in a series of articles on creatures as diverse as sea anemones and snails, animal intelligence and the flock movements of birds. Illustrated. SA.

DAYS WITHOUT TIME. Edwin Way Teale. Dodd, Mead. $7.50. The adventures of a naturalist. S.

HANDBOOK OF NATURE STUDY. 24th edition. Anna Botsford Comstock. Allen. 1947. $5.75. An excellent general reference and teacher's guide. Over 1,000 illustrations. 957 pages. PIA.

TRACKS AND TRAILCRAFT. Ellsworth Jaeger. Macmillan. 1948. $4.75. Hundreds of tracks are described and illustrated with clear pen-and-ink sketches. SA.

WILDWOOD WISDOM. Ellsworth Jaeger. Macmillan. 1945. $3.95. This fascinating manual of woodlore has chapters dealing specifically with fire-making and control; edible, poisonous and useful plants and trees; useful animals and birds. Fully illustrated with drawings and diagrams. SA.

BY MAP AND COMPASS. C. A. Mustard. Macmillan. 1950. 65 cents. Map reading for young people. S.

ARCTIC UNFOLDING. Nicholas Polunin. Book Society. 1949. $5.50. Descriptions of plant, animal and bird life are accurate and vivid. A book of unusual merit. Illustrated. 340 pages. SA.

A FIELDBOOK OF NATURAL HISTORY. E Laurence Palmer. McGraw-Hill, 1949. $8.25. The most comprehensive one-volume guide to natural history available to-day. It embraces birds, fish, plants, rocks and minerals, the stars, mollusks, reptiles and mammals—more than 2,000 items and hundreds of pictures arranged and tabulated for easy reference. SA.

DR. GEORGE WASHINGTON CARVER, SCIENTIST. S. Graham and D. G. Lipscomb. Book Society. 1950. $1.25. A biography of the great negro scientist, complete with notes, index. Canadian edition, well printed and sturdily bound. 224 pages. SA.

BIOLOGY: THE WORLD OF LIVING THINGS. Various authors. Ryerson. $2.75. The whole world of plants and animals, including man, classification of plants and animals, reproduction, response to environment, etc. 275 illustrations. SA.

THE BOOK OF NATURALISTS. Wm. Beebe. Knopf, Toronto. 1944. $5.75. A.

THE STORY OF LIVING THINGS AND THEIR EVOLUTION. Eileen Mayo. McClelland. $10.00. I.

FIELD BOOK OF NATURE ACTIVITIES. William Harcourt. Allen. 1950. $4.50. An indispensable guide for nature lovers; a wealth of ideas for every nature hobby and every branch of nature. ISA.

THRILLS OF A NATURALIST'S QUEST. Raymond Ditmars. Macmillan. 1947. $4.95. Stimulating reading for a growing boy or girl. SA.

THE MAKING OF A SCIENTIST. Raymond Ditmars. Macmillan. 1947. $4.95. A wealth of ideas for anyone interested in natural science. SA.

OUR LIVING WORLD. Carroll Lane Fenton. Doubleday. $4.25. The story of all living things told by an outstanding scientist. Illustrated with many line drawings and fifteen pages of halftones. ISA.

CONSERVATION

OUR PLUNDERED PLANET. Fairfield Osborn. McLeod. Reprint edition, 1951. $1.39. Well written, interesting and moving account of the present status of the world's natural resources. A.

CONSERVATION IN AMERICA. Mary I. Curtis. Ryerson. $1.75. Why conservation is necessary and what is done about it. Illustrated by photographs. IS.

SOIL CONSERVATION. An International Study. Ryerson. $2.00. How soil erosion happens and how it can be checked on farm lands, range lands and forest lands. An F.A.O. publication available in both French and English. SA.

FOOD OR FAMINE: The Challenge of Erosion. Ward Shepard. Macmillan. 1945. $4.75. Starting from the basic fact that world-wide soil erosion is an ominous threat to civilisation, the author raises and systematically answers the question, what are we going to do about it? Illustrated with photographs. 210 pages and index. SA.

LET THEM LIVE. Dorothy P. Lathrop. Macmillan. 1951. $2.25. For children and for nature lovers of all ages. Stories of twenty birds and animals, and of their place in nature. Illustrated with twenty beautiful full-page pictures. PIS.

WILDLIFE MANAGEMENT. Ira N. Gabrielson. Macmillan. 1950. $5.25. In this book Dr. Gabrielson outlines the basic concepts of wildlife management, and then discusses the problems which confront wildlife managers and the means available for attacking these problems. Illustrated. SA.

THE EARTH'S FACE AND HUMAN DESTINY. Dr. Ehrenfried Pfeiffer. McClelland. 1947. $3.50. The landscape and its relation to the health of the soil. A.

FIRE. Geo. R. Stewart. Random House. 1948. $3.50. A true story of a forest ranger. IS.

ROAD TO SURVIVAL. William Vogt. McLeod. 1948. $5.25. A revolutionary new view of the world—of its multiplying peoples and its wasting riches. Man's so-called conquest of nature is shown to be a suicidal process whereby the world, a sanctuary without exits for a fast-breeding race, is rapidly being made uninhabitable. A.

RICH LAND, POOR LAND. Stuart Chase. McGraw-Hill. 1936. $6.50. A comparison between America to-day and as it originally was. Practical suggestions on how to save our natural resources. A.

THE LAND AND WILDLIFE. Edward H. Graham. Oxford. 1947. $4.00. Graphic account of the relation of the American land to its wildlife. Fully illustrated with photographs. AS.

THE LAND RENEWED. The story of soil conservation. Wm. R. Van Dusal and Edward H. Graham. Oxford. 1946. $2.00. A picture book of how soil conservation works with brief explanatory text opposite each photograph. A.

BURNING AN EMPIRE. Stuart H. Holbrook, Macmillan. 1944. $4.00. A story of forest fires in the United States. Fully illustrated. SA.

OUT OF THE EARTH. Louis Bromfield. Musson. $4.50. All the latest discoveries for soil improvement of the last few years. SA.

CONSERVATION IN THE UNITED STATES. C. H. Guise, W. J. Hamilton, and H. Ries. Allen. Third edition, 1949. $5.75. A complete treatise of principles involved and of all natural resources: soil, its depletion, erosion, conservation; forests; fisheries, fur, game and other wild life; minerals, metals, etc.; applicable to Canada. 534 pages. SA.

USING AND MANAGING SOILS. A. F. Gustafson. McGraw-Hill. 1948. $3.50. How to conserve soil and its properties, and how to use it to best advantage. A.

WATER, LAND AND PEOPLE. Bernard Frank and Anthony Netboy. Knopf. 1950. $4.50. A dramatic picture of the growing water famines and floods, the human consequences, and possible remedies. A.

THE LIVING SOIL. E. B. Balfour. British Book. $3.25. A new and revised edition. SA.

THE VALUE OF SOIL CONSERVATION. Alfred W. Philips. Nelson. 1950. 75 cents. Problems of conserving soil, water and wildlife. EA.

PLANTS

OUR FLOWERING WORLD. Rutherford Platt. Dodd, Mead. 1947. $7.00. Interesting account of the appearance of flowering plants upon the earth. Illustrated with fine photographs, some in natural colour. SA.

THE WORLD OF PLANT LIFE. Clarence J. Hylander. Macmillan. 1944. $5.75. Plants in their native haunts. 722 pages. A.

GREEN GLORY. Richard St. Barbe Baker. Ryerson. $2.50. The story of the forests of the world with emphasis on conservation particularly in North America. 63 pages of photographic illustrations. SA.

STORIES IN TREES. Mary I. Curtis. Ryerson. $1.40. Fourteen tree legends and fourteen stories about trees and conservation. Illustrated. I.

TREE TRAILS AND HOBBIES. Ruth Cooley Cater. Doubleday. $4.00. More than 200 species of trees are represented in this well-organized and well-written book on American trees—giving the characteristics, habitats, appearance, oddities for quick identification. SA.

WILD FLOWER GUIDE. Northeastern and Midland United States. Edgar T. Wherry. Doubleday. 1948. $3.50. Illustrated guide to the identification of wild flowers. Many pictures in colour. AS.

PLANT GALLS AND GALL MAKERS. E. P. Felt. Allen. 1940. $4.75. A guide to the identification of two thousand kinds of plant galls; classified by host plants and descriptive keys. Over 700 illustrations. 364 pages. SA.

AMERICAN WILD FLOWERS. Harold N. Moldenke. Van Nostrand. 1949. $9.00. With 88 plates in full colour and 67 plates in black-and-white. S.

BEGINNERS GUIDE TO WILD FLOWERS. Ethel Hinchley Hausman. Allen. 1948. $4.50. A complete guide with more than 1,000 illustrations. PISA.

FIELD BOOK OF AMERICAN WILD FLOWERS. F. Schuyler Mathews. Allen. 1927. $4.00. Handbook for the identification of wildflowers east of the 100th meridian; flowers grouped by families. 32 full-page colour plates and 400 other illustrations. 558 text pages. ISA.

THE HOME BOOK OF TREES AND SHRUBS. J. J. Levison. Knopf. $10.00. A.

COMMON EDIBLE MUSHROOMS. Clyde M. Christensen. Allen. 1943. $2.65. A safe guide for identifying, gathering, and cooking mushrooms—the fool-proof four, and fifty additional kinds; descriptions of ten poisonous species. 83 illustrations, 18 in colour. 124 pages. ISA.

KEYS TO WOODY PLANTS, Fifth edition, revised. W. C. Muenscher. Allen. 1946. $1.50. For the beginner for use in both summer and winter. 108 pages. SA.

ALL ABOUT HOUSE PLANTS. Montague Free. Doubleday. $4.00. The amateur's guide to the successful indoor culture of flowers, foliage plants, shrubs, bulbs, vines, etc. Illustrated with colour plates, halftones and line drawings. Index. SA.

THE PICTURE PRIMER OF INDOOR GARDENING. Margaret O. Goldsmith. Allen. 1946. $2.25. Highly practical guide to growing plants indoors; interestingly written and attractively illustrated in colour. SA.

THIS GREEN WORLD. Rutherford Platt. Dodd, Mead. 1942. $6.00. Popular information, interestingly presented, describing how plants live, with special reference to trees. Beautifully illustrated with photographs; some in colour. SA.

FIELD BOOK OF COMMON FERNS. Herbert Durand. Allen. Revised, 1949. $4.00 52 photographs and 60 outline drawings. 220 pages. ISA.

FIELD BOOK OF COMMON MUSHROOMS. William S. Thomas. Allen. Revised, 1948. $4.00. 164 species described; directions for collecting and cooking. 16 colour plates of 96 species; 200 other illustrations. 384 pages. SA.

NATIVE TREES OF CANADA—4th edition, Bulletin 61. The King's Printer, Ottawa. $1.50. Excellent illustrations and comprehensive material on all northern trees and shrubs. PISA.

FLOWERS. Zim and Martin. Musson. $1.50. A pocket-sized guide to familiar flowers, containing full colour pictures on each page. I.

SALT-WATER LIFE

NATURAL HISTORY OF MARINE ANIMALS. G. E. and N. McGinitie. McGraw-Hill. 1949. $8.45. A practical, simple, yet thoroughly scientific guide to the ocean as an environment and the animals that live there. SA.

STRANGE SEA LIFE. Gladys Vondy Robertson and Vera M. Graham. Clarke, Irwin. $3.25. The simple language in which obscure facts are told is perfectly matched by the clear black-and-white illustrations of Michael Bevans. ISA.

A FIELD GUIDE TO THE SHELLS. Percy A. Morris. Allen. Revised and enlarged edition, 1951. $4.00. A practical handbook for the identification of marine shells: size, distribution, colour, markings; habits; value to man. SA.

BEGINNER'S GUIDE TO SEASHORE LIFE. Leon A. Hausman. Allen. 1949. $2.50. Over 250 of the most common forms of animal life found on the seacoasts of Canada and the United States. 250 illustrations. ISA.

THE OCEAN BOOK. John Y. Beaty. Ryerson. $1.65. IS.

FRESH-WATER ANIMALS

AQUATIC PLANTS IN THE UNITED STATES. Walter Conrad Muenscher. Allen. 1944. $5.75. Plants in fresh, brackish, and salt water; arranged by families. 157 illustrations and 400 maps. 374 pages. SA.

THE LIFE OF INLAND WATERS. An Elementary Textbook of Fresh-Water Biology for Students. James G. Needham. Allen. Third Edition, 1937. $4.00. Deals with fresh-water life: its forms, conditions. fitness, economic aspects. 244 illustrations. 438 pages. SA.

BEGINNER'S GUIDE—FRESH-WATER LIFE. Leon A. Hausman. Allen. 1950. $2.50. Over 250 of the most common forms of animal life found in rivers, lakes, marshes, etc., of Canada and the United States. Over 250 illustrations. ISA.

THE RIVER BOOK. John Y. Beaty. Ryerson. $1.65. IS.

INSECTS

INTRODUCING THE INSECT. F. A. Urquhart. Illustrated by E. B. S. Logier. Clarke, Irwin. $5.00. Both author and illustrator are distinguished members of the staff of the Royal Ontario Museum. This is a book for the whole family, and it contains Dr. Urquhart's own valuable key to identification of species. ISA.

AMERICAN SOCIAL INSECTS. Charles D. and Mary H. Michener. Van Nostrand. 1950. $9.00. Deals with the life story of the bees, ants, wasps, and termites. Illustrations show these insects in their natural settings. S.

ANT HILL ODYSSEY. William M. Mann. Little, Brown. $4.00. The author has travelled to all parts of the world to collect bugs, butterflies, snakes and all sorts of small animals. S.

THE GOLDEN THRONG. Edwin Way Teale. Dodd, Mead. $6.00 Interesting story of the life of the honey bee. Illustrated with many exceptional photographs by the author. A.

THE LIFE OF THE BEE. Maurice Maeterlinck. Dodd, Mead. $3.00. I.

A MULTITUDE OF LIVING THINGS. Lorus J. and Margery F. Milne. Dodd, Mead. $5.00 An exciting nature story of multitudes of insects. I.

INSECTS IN YOUR LIFE. C. H. Curran. McLeod. $4.50. Dr. Curran writes clearly and colourfully about all types of insects from the familiar household variety which annoy and cause damage to human habitations and property, to exotic and unusual winged creatures who have such an amazing adaptation to life in the air and on the ground. ISA.

THE LIFE OF THE QUEEN BEE. Louis Sutherland. Book Society. 1946. $3.25. The complete range of bee life. 20 photographic illustrations. 126 pages. I.S.

AMERICAN SPIDERS. Willis J. Gertsch. Van Nostrand. 1949. $9.00. A description of the kinds of spiders found in America, the way they are classified, and how they live, work, and reproduce. S.

INSECTS AND HUMAN WELFARE. Charles T. Brues. Book Society. 1947. $4.00. An advanced and readable book, revised in the light of new developments in insect control. 154 pages. IS.

THE SPIDER BOOK. John Henry Comstock. Allen. Revised Edition, 1940. $7.00. A manual for the study of spiders and their relatives; anatomy and life habits. 770 illustrations. 740 pages. SA.

FIELD BOOK OF INSECTS. Frank E. Lutz. Allen. Third Edition, revised 1948. $4.00. Recognition and habits of insects living in the air, in water, in the ground. Over 800 illustrations, 24 in colour. 520 pages. SA.

THE BUTTERFLY BOOK. W. J. Holland. Doubleday. $15.00. A new edition, completely revised, and enlarged, covering every butterfly in the United States and Canada. ISA.

INSECTS. Zim and Cottam. Musson. $1.50. A pocket sized guide to familiar insects containing full colour pictures on each page. I.

FISH

THE FRASER. Bruce Hutchison. Clarke, Irwin. $4.50. The chapters on salmon conservation and the great B.C. run are thrilling and informative reading. SA.

REPRESENTATIVE NORTH AMERICAN FRESHWATER FISHES. John T. Nichols. Macmillan. 1942. $1.75. Brief information about common fishes. Illustrations in colour. AS.

NORTHERN FISHES. Samuel Eddy and Thaddeus Surber. Allen. Second Edition, revised, 1947. $4.00. Authoritative information for 150 species: their environment, food, habits. Well illustrated in colour. 276 pages. SA.

THE WAYS OF FISHES. Leonard Schultz and Edith M. Stern. Van Nostrand. 1948. $6.50. A description of many strange and colourful fishes; their habits, eating, mating and temperaments is given in a popular style. S.

RETURN TO THE RIVER. Roderick L. Haig-Brown. Collins. 1946. 98 cents. The story of Chinook River salmon. SA.

FROGS

HANDBOOK OF FROGS AND TOADS. A. H. Wright and A. A. Wright. Allen. Third Edition, 1949. $7.50. An authoritative reference book of frogs and toads of North America: appearance, habitats, habits, voices; keys for identification. 126 illustrations; 37 maps. 652 pages. SA.

REPTILES

THE REPTILES OF NORTH AMERICA. Raymond L. Ditmars. Doubleday. 1936. $4.00. Well illustrated account of all reptiles of the United States and northern Mexico, with special reference to their identification. AS.

HANDBOOK OF LIZARDS. Hobart M. Smith. Allen. 1946. $6.75. 136 species described. 271 illustrations; 41 maps. 578 pages. SA.

REPTILES AND AMPHIBIANS. Walter J. Breckinridge. Allen. 1944. $2.85. A complete handbook for scientists and students. 52 illustrations. 202 pages. SA.

BIRDS

ONTARIO BIRDS. L. L. Snyder. Illustrated by T. M. Shortt. Clarke, Irwin. 1951. $4.50. This valuable volume is concerned with the anatomy, distribution, migration, and classification of birds of Ontario, and is illustrated with 146 drawings. SA.

MENABONI'S BIRDS. Athos and Sarah Menaboni. Clarke, Irwin. 1950. $10.00 The most discussed book of birds since Audubon. Magnificent drawings, many in colour, by Athos Menaboni, and a charming and authoritative text by his wife. SA.

AUDUBON'S AMERICAN BIRDS. Sacheverell Sitwell. Clarke, Irwin. $1.30. Printed in colour from the original plates. Text by one of Britain's leading men of letters. Any age.

AUDUBON BIRD GUIDE TO EASTERN LAND BIRDS. Text by Richard H. Pough, illustrated by Don Eckleberry. Doubleday. 1946. $3.50. Text covers identification, nest, range, habits and voice of 275 species. Over 400 illustrations in colour. AS.

AUDUBON WATER BIRD GUIDE: Water. Game and Large Land Birds. Richard H. Pough. Doubleday. 1951. $3.00. SA.

HOW TO KNOW THE BIRDS. Roger Tory Peterson. Allen. 1949. $2.25. An introduction to bird recognition: field marks, actions, families. 400 drawings. ISA.

A FIELD GUIDE TO THE BIRDS (EASTERN). Revised and enlarged edition. Roger Tory Peterson. Allen. 1947. $4.00. Popular identification guide: 1,000 illustrations, 500 in full colour; 60 full-page plates and accompanying tables to help distinguish birds which look alike. ISA.

A FIELD GUIDE TO WESTERN BIRDS. Roger Tory Peterson. Allen. 1941. $4.00. A complete guide for British Columbia. Well illustrated. 240 pages. ISA.

BIRDS IN THE GARDEN AND HOW TO ATTRACT THEM. Margaret McKenny. Allen. 1939. $5.00. A guide to companionship with birds about the home; bird sanctuaries, homes, feeding devices. 16 full-colour portraits. 349 large pages. ISA.

FIELD BOOK OF EASTERN BIRDS. Leon Augustus Hausman. Allen. 1946. $4.00. Each bird treated on its own page: field marks, description, habits, notes, habitat, range. 6 colour plates and 400 drawings. 659 pages. ISA.

WILD BIRDS AND THEIR MUSIC. F. Schuyler Mathews. Allen. 1921. $4.00. Identification by songs, appearance, habits. 71 full-page plates, mostly in colour. 325 pages. SA.

BIRD GUIDE. Land Birds East of the Rockies. Chester A. Reed. Doubleday. New Edition, 1951. $1.75. Fully illustrated in colour. SA.

HOW TO ATTRACT THE BIRDS. Robert S. Lemmon. Doubleday. 1947. $2.00. A very practical book describing how to feed birds, make feeders, bird houses, and what to plant to provide food and shelter for birds. ISA.

BOOK OF BIRD LIFE. Arthur A. Allen. Van Nostrand. 1930. $5.25. Popular discussion of bird life in general and methods of bird study. Well illustrated. SA.

BIRDS OVER AMERICA. Roger Tory Peterson. Dodd, Mead. $7.50. A.

FLASHING WINGS. Richard Merrill Saunders. McClelland. 1947. $4.50. A guide to an entertaining hobby; authoritative and full of bird watching lore. Charts. SA.

THE ART OF BIRD PHOTOGRAPHY. Eric Hosking and Cyril Newberry. British Book. $3.00. An indispensable companion to all who enjoy watching or photographing birds. A Country Life publication. A.

A GUIDE TO BIRD WATCHING. J. J. Hickey. Oxford. $4.00. SA.

HANDBOOK OF ATTRACTING BIRDS. Thomas P. McElroy Jr. Knopf. $3.00 A. guide in attracting birds and information on feeding and housing of birds gives new experiences in the field of conservation. A.

BIRDS. Zim and Gabrielson. Musson. $1.50. A pocket-sized guide of familiar birds containing full-colour pictures on each page. IS.

MAMMALS

A FIELD GUIDE TO THE MAMMALS. W. H. Burt. Allen. 1951. $4.00. Colour paintings of 188 species; 111 photographs. ISA.

LIFE THROUGH THE AGES. Charles R. Knight. Knopf. 1946. $2.50. The story of prehistoric animals and their modern descendants. P.

ANIMALS ALIVE. Austin H. Clark. Van Nostrand. 1948. $5.75. Explains the relation of the animal world to man, the relations of various kinds of animals to each other, to plants, to their physical environment on the land, in fresh water and in the sea. S.

THE VANISHING WILDERNESS. Francesca LaMonte and Michela Welch. Book Society. 1949. $3.29. The life stories of 19 wild animals which make their homes in the fast receding wilderness. Woven into these stories is a background of history, biology and geography. Full colour plates and many sketches. 340 pages. SA.

ANIMALS OF THE WORLD. Ed. J. Walker McSpadden. Doubleday. $4.98. Authoritative and comprehensive. Virtually every mammal, both wild and domestic, is described in detail. SA.

WILD LIFE OF THE WORLD ILLUSTRATED. Ryerson. $2.75. Designed to be read as literature and written in simple non-scientific language. 200 pages of illustrations. SA.

MEETING THE MAMMALS. Victor H. Cahalane. Macmillan. 1944. $3.00. An excellent guide to many outstanding North American mammals. Attractively illustrated with drawings in black-and-white. SA.

FIELD BOOK OF ANIMALS IN WINTER. Anna H. Morgan. Allen. 1939. $4.00. Describes how animals which must endure cold winters find food or exist without it, secure shelter, face the weather, or migrate; most groups of animals included. ISA.

FIELD BOOK OF NORTH AMERICAN MAMMALS. H. E. Anthony. Allen. 1928. $5.75. 32 Plates in colour; over 200 other illustrations. 625 pages. ISA.

REINDEER TREK. Allen Roy Evans. McClelland. $2.75. A tale of the long and hazardous trek of 3,000 reindeer from Buckland Bay, Alaska, eastward to the fertile mosses bordering the waters of the Great River. S.

ROCKS AND MINERALS

OUR AMAZING EARTH. Carroll Lane Fenton. Doubleday. 1945. $5.25. History of the earth, the rocks that compose it, and forces at work altering the earth's appearance. Excellent authentic introduction to study of geology, presented in interesting popular style, fully illustrated with drawings and photographs. ISA.

THE ROCK BOOK. Carroll Lane Fenton and Mildred Adams. Doubleday. 1945. $6.75. Popular authentic account of common rocks and minerals, their appearance, formation and use. 357 pages. Illustrated with drawings. 48 photographs and 4 large colour plates. AS.

STORIES IN ROCKS. Henry Lionel Williams. Clarke, Irwin. $4.25. A well illustrated book which gives the elements of geology, and contains a glossary and an index. IS.

FIELD BOOK OF COMMON ROCKS AND MINERALS. Frederick B. Loomis. Allen. 1948. $4.00. For identifying rocks and minerals of Canada and the United States and interpreting their origins and meanings. 47 coloured plates and 100 other illustrations. 352 pages. SA.

THE MOUNTAIN BOOK. John Y. Beaty. Ryerson. $1.65. Tells in story form the physical features, animal life, plant life and conservation aspects of the subject. IS.

NATURE AND PROPERTIES OF SOIL. Lyon Buckman. Macmillan. 1943. $5.50. Semi-technical textbook. A.

ELEMENTS OF GEOLOGY: PHYSICAL AND HISTORICAL. William J. Miller. Van Nostrand. 1939. $5.00. This book makes it easy to understand and master geological fundamentals. A.

THE SOILS THAT SUPPORT US. Charles E. Kellogg. Macmillan. 1947. $4.75. Simple description of kinds of soil, how formed, and their relation to living things and to people. A very readable and interesting book. SA.

WEATHER

WEATHER FOR ALL. George H. T. Kimble. Longmans. $4.25. A complete book about the weather for adults and older boys and girls, and particularly for gardeners, sailors, fishermen, hikers and outdoor sportsmen. SA.

KNOWING THE WEATHER. T. M. Longstreth. Macmillan. 1945. $1.85. A clear and simple guide to home weather forecasts by observation of cloud formation, wind pressure, temperature, rain and snow with a thorough discussion of the forecaster's tools and the structure of the atmosphere. Illustrated. ISA.

CLOUDS, WEATHER AND FLIGHT. T. C. Gilmer and Erich Nietsch. Van Nostrand. 1944. $6.50. Popular guide to weather, what makes it, how to forecast and read weather maps, relation of weather to aviation. Abundantly illustrated with drawings, charts and photographs. 161 pages. A.

STARS

THE UNIVERSE OF LIGHT. Sir W. H. Bragg. Clarke, Irwin. $3.50. A standard work. Fully illustrated. SA.

A FIRST BOOK OF METEOROLOGY. Arthur J. Star. Clarke, Irwin. $1.25. Fully illustrated. SA.

WHEN THE STARS COME OUT. Robert H. Baker. Macmillan. 1944. $4.00. Excellent guide to the heavens. 188 pages. SA.

SUN, MOON AND STARS. W. T. Skilling and R. S. Richardson. McGraw-Hill. 1946. $3.75. An introduction to astronomy, written especially for teen-agers. IS.

THE EARTH AND THE STARS. Charles G. Abbott. Van Nostrand. 1946. $6.50. An absorbing story of the enigma of the universe; of the stars and constellations and their relationship to the earth.S.

WHAT'S IN THE SKY. Miriam Phillips Dunham. With illustrations by Dorothy Waugh. Oxford. 1946. $1.00. Simple explanation of the solar system, stars, nebulae, comets, meteors, light years, and use of spectrum telescope. PI.

BOOKS FOR THE YOUNG

LET'S GO OUTDOORS. Harriet E. Huntington. Doubleday. $3.00. Simple text and photographs of microscopic detail, which give entertaining and scientific answers to the questions of young children just discovering outdoor creatures. Ages up to 9.

LET'S GO TO THE SEASHORE. Harriet E. Huntington. Doubleday. $3.00. Simple text tells scientific facts about the small creatures that live in the sea, on the seashore, and on the rocks under the water. Ages up to 9.

LET'S GO TO THE DESERT. Harriet E. Huntington. Doubleday. $3.00. Clear words and pictures introduce desert plants and animals. Ages 6-9.

THE LAND WE LIVE ON. Carroll Lane Fenton. and Mildred Adams. Doubleday. $3.00. The land and how it came to be—what things change it—and how to live on it—in revealing photographs and clear text. Ages 6-12.

TARKA THE OTTER. Henry Williamson. Book Society. 1949. $3.75. A modern classic. One of the great nature books of all times. 260 pages. Ages 5-9.

MASKED PROWLER. John and Jean George. Book Society. 1950. $3.25. The adventures of a racoon in his home in the forests of Michigan. A remarkable story. Beautifully illustrated. 183 pages. Ages 5-9.

VISON, THE MINK. John and Jean George. Book Society. 1949. $3.25. Authentic nature lore written with drama and warm understanding. A book for everyone, regardless of age. Illustrated. 184 pages. Ages 5-9.

VULPES, THE RED FOX. John and Jean George. Book Society. $3.25. Vulpes is a character worthy of a place among the memorable heroes of animal literature. Pictorial endpapers and 58 illustrations by Jean George. Ages 5-9.

UP ABOVE AND DOWN BELOW. Irma E. Webber. Book Society. 1948. $1.25. Plant propagation for young folk. Ages 4-8.

TRAVELLERS ALL. Irma E. Webber. Book Society. 1944. $1.50. How plants move from place to place. Ages 4-8.

ANYWHERE IN THE WORLD. Irma E. Webber. Book Society. $1.75. A basic book on plant and animal adaptation. Well illustrated. Ages 4-8.

WHITE TAIL, King of the Forest. N. Smock. Book Society. $1.35. A young boy finds and cares for an orphaned fawn until the day when his pet is ready to return to the forest. Grades 3-4.

HOMES AND HABITS OF WILD ANIMALS. K. P. Schmidt. Book Society. $2.75. Life histories of the otter, beaver, fox, bear, deer, moose, opossum. Similar in format to the above. Pictures separately, $1.50. Grades 4 and up.

FRIENDLY ANIMALS. K. P. Schmidt. Book Society. $2.75. The story of our domestic animals and of the wild animals of the forest and plains to whom they are related. Pictures separately, $1.50. Grades 4 and up.

A PET BOOK FOR BOYS AND GIRLS. Alfred Morgan. Book Society. $3.50. How to train, house and care for pets. Grades 4-8.

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ANIMAL TRACKS. George F. Mason. Collins. $2.50. Juveniles.

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BOOKS BY ALICE GALL AND FLEMING CREW. Oxford. Charming and authentic nature stories. (1) Flat Tail. The story of a beaver. $1.75. (2) Little Black Ant. Scientifically accurate and imaginative. $1.75. (3) Ringtail. The story of a young racoon. $1.75. (4) Splasher. A young muskrat. $2.50. (5) Wagtail. The story of a tadpole. $2.00. (6) Winter Flight. Adventures of crows. $3.00. Grades 4-6.

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WARM EARTH. Dorothy Waugh. Oxford. 1943. $1.00. Children who garden and who like to watch things grow will enjoy this beautifully illustrated book with interesting text explaining what goes on under the surface of the warm earth. PI.

BIRDS IN THEIR HOMES. Addison Webb. Doubleday. 1947. $2.50. Interesting children's book about common birds. Well illustrated in colour. PI.

THE STARS FOR CHILDREN. Gaylord Johnson. Macmillan. $2.25. The first part of this book tells about the stars; the second part is about the moon and other planets. Clear explanations are given of how the stars move, the reasons for day and night etc. Illustrated. P.

THE EARTH BENEATH OUR FEET. Alice Wilson. Macmillan. 1947. $2.50. Educational edition. $2.00. The wonderful story of the solid earth beneath our feet is here told simply and dramatically for boys and girls by a well-known Canadian geologist. It is an exciting story with great appeal for children on a subject which they can explore for themselves. Illustrated. PI.

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GENERAL REFERENCES—Seven bulletins. Winter Sleep. How Animals Live in Winter. Track Stories in Mud, Sand and Snow. Fliers and Gliders in Nature. Terrariums. The Elementary School Science Room. Nature Crafts and Other Things to do in Nature.

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NATIONAL AUDUBON SOCIETY

Inquiries relative to the following activities should be addressed to the National Audubon Society, 1000 Fifth Avenue, New York, 28, N.Y.

PHOTOGRAPH AND FILM DEPARTMENT, from which wildlife photographs and slides can be purchased, and educational films rented.

SERVICE DEPARTMENT, through which recommendations as to nature books, bird and flower cards and bird leaflets, may be obtained. These items, purchased as educational material, are subject to clearance through the Canadian customs by the purchaser.

PUBLICATIONS: *Audubon Magazine*, $2.50 per year (six issues) in the United States, its possessions and Canada. *Audubon Field Notes*, $2.00 per year (six issues) contain results of bird watching, including seasonal reports, breeding, bird census, and Christmas bird counts.

AUDUBON SCREEN TOURS, lectures and coloured motion pictures, which appear in more than 140 cities annually in the United States and Canada.

AUDUBON SOCIETY OF CANADA

Inquiries relative to the following activities and publications should be addressed to the Audubon Society of Canada, 177 Jarvis Street, Toronto 2, Ontario.

AUDUBON JUNIOR CLUBS. Form a club now and introduce your class or youth group to the fun of outdoors exploration—around their homes, in the park, in the country. You can use Audubon Junior Clubs to teach conservation, geography, English, natural science, art, social studies. Ten children of any age plus an adult advisor (the teacher or youth leader) constitute a club. The advisor sends dues of 15 cents for each child member plus $1.00 registration fee. *Every member receives* a membership button and certificate and 8 four-page leaflets, six about birds, 1 about a mammal, 1 about activities; 7 colour plates to illustrate the bird and mammal leaflets. *Every club receives* Audubon Junior Club News, a club newspaper published four times each school year. *Every club advisor* receives Canadian Nature Magazine and Audubon Teachers Guide.

CANADIAN NATURE MAGAZINE. An informative magazine for everyone who wishes to explore the outdoor world. Articles on birds, mammals, reptiles, insects, astronomy, trees, flowers, marine life and geology make Canadian Nature a fascinating source of entertainment and information for adults and youngsters alike. Published five times each year. The *September* issue features soil conservation; *November*, water and mineral conservation; *January*, forest conservation; *March*, recreation and scenic attractions; *May*, wildlife conservation. With beautifully illustrated articles, many in colour, Canadian Nature is particularly adapted to the needs of teachers and nature students of college and school age. Subscription: $1.50 for all five issues.

GOVERNMENT OFFICES

Listed below are government departments and bureaus, to whom teachers, senior students and youth leaders may apply for information and currently available booklets. When writing state your problems or requirements clearly, and in detail. Give your name, school position or affiliation, and address. Otherwise literature may not be made available. Printed material is costly and can only be sent to those who give assurance that it will be used to advantage.

DEPARTMENT OF AGRICULTURE, OTTAWA. Write for list of publications which is free on reauest. It contains many free bulletins, charts and folders, films and filmstrips that are useful in teaching.

DEPARTMENT OF FISHERIES, OTTAWA. At the present time this department is planning new developments in the field of education. Write to the Director, Information Service.

NATIONAL MUSEUM OF CANADA. Inquiries for material on birds, fur-bearers, dinosaurs, phases of Indian or Eskimo life, reference books and films should be directed to The Curator, National Museum, Ottawa.

NATIONAL FILM BOARD, OTTAWA. NFB produces and distributes films, filmstrips, photographs, displays, and other visual media on all aspects of Canada— its resources, industries, arts, agriculture, natural life, landscapes and human character. NFB through its ten regional offices in Vancouver, Edmonton, Regina, Winnipeg, Toronto, Montreal, Fredericton, Halifax, Charlottetown and St. John's, and its field representatives attached to each office, assists in selecting, screening, and developing effective film use. Education and information films and filmstrips can be obtained from NFB, provincial Departments of Education, and 235 film libraries in the larger municipalities. Teacher's guides or notes are prepared and distributed with most films and filmstrips intended for classroom use. NFB services are free, but many local libraries levy a small handling charge. Information concerning films, filmstrips, or projection services may be obtained by contacting or writing the NFB office in your province.

DEPARTMENT OF RESOURCES AND DEVELOPMENT, OTTAWA. The Development Services Branch has a variety of material on the Arctic; the Canadian North; forests, forest conservation, bird protection, feeding stations for birds, recreation playgrounds, historic and national parks, as well as many coloured photographs, slides and films.

CANADIAN GOVERNMENT TRAVEL BUREAU, OTTAWA. Although the material is largely planned for tourists much of it is of value to the teacher or leader. One set of this literature may be supplied to each school library on the request of teacher or principal.

PROVINCIAL DEPARTMENTS. Each province maintains a service for public educators. Much free material and material for loan may be obtained from these departments by writing to the one in your own province and securing their list of publications.

AGRICULTURAL COLLEGES provide a fund of information on a variety of subjects and supply films or filmstrips on a limited range of topics.

PUBLISHERS' ADDRESSES

ALLEN	Thomas Allen Limited, 266 King St. W., Toronto.
BOOK SOCIETY	The Book Society of Canada, Ltd., 88 Richmond St. W., Toronto.
BRITISH BOOK	British Book Service (Canada) Ltd., 265 Adelaide St. W., Toronto.
CLARKE IRWIN	Clarke, Irwin & Co. Ltd., 103 St. Clair Ave. W., Toronto.
COLLINS	Wm. Collins Sons & Co., Ltd., 53 Avenue Rd., Toronto, 5.
DODD MEAD	Dodd, Mead & Co. (Canada) Ltd., 215 Victoria St., Toronto.
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LITTLE BROWN	Little, Brown & Co., 215 Victoria St., Toronto.
LONGMANS	Longmans, Green & Co., 215 Victoria St., Toronto.
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McCLELLAND	McClelland & Stewart Ltd., 228 Bloor St. W., Toronto, 5.
McGRAW-HILL	McGraw-Hill Co. of Canada Ltd., 50 York St., Toronto.
McLEOD	George J. McLeod Limited, 117 Peter St., Toronto.
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OXFORD	Oxford University Press, 480 University Ave., Toronto, 2.
RANDOM HOUSE	Random House of Canada Ltd., 1149 King St. W., Toronto.
RYERSON	The Ryerson Press, 299 Queen St. W., Toronto.
VAN NOSTRAND	D. Van Nostrand Co. (Canada) Ltd., 228 Bloor St. W., Toronto, 5.

PHOTOGRAPHS WANTED of adults or children happily engaged in indoor or outdoor nature activities such as hiking, collecting, observing, modelling, blueprinting, etc. Photographs accepted will be paid for at our regular rates and judged for human interest and action, for clearness and good composition. Package securely and mail to Audubon Society of Canada, 177 Jarvis St., Toronto 2, Canada.

ONE LAST WORD!

Marie E. Gaudette

After you have read this book—if you have—we hope you will have gathered the following:

1. There must be *some* fun, lightness, and fellowship in the teaching of nature or it becomes as dry as a bug on a pin.

2. Never let a lack of knowledge keep you from opening the door of nature to someone else. We all had to begin somewhere, and most of us can remember labouring over C-A-T and D-O-G and not being too sure which was which!

3. If you lack knowledge in nature *never be ashamed of it.* Anyone who would laugh at you is not worth his salt!

4. Keep your eyes open to find ways to put nature knowledge to work for the community. It can be and is done—but it takes imagination. You have *that,* haven't you?

5. Never lose patience when helping other people to learn. Learning flows more easily through the channels of kindness and encouragement.

6. Do every bit of nature you can out-of-doors rather than indoors.

7. As far as you can, keep nature a study of "living things as they *live*" rather than a study of dead things.

8. Be as enthusiastic about another person's first robin as though it were not your 2,499th of the season!

9. Learn along with your group, even if you can't keep one step, or a half-step, ahead.

10. Go out, keep your eyes open, your ears cocked, your nose sniffing, hands free, mouth shut, and feet dry! Good luck!

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